THE KOREAN WAY WITH DATA

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THE KOREAN WAY WITH DATA: A RESEARCH REPORT

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Introduction

As the globe enters the next phase of the digital revolution, what was once considered as merely commercial and technological competition is now being presented as an existential geopolitical one.

Many think that the world is fracturing into two spheres: a Sinocentric order and a US-centric order, as a result of the emergence of a deep-seated, multidimensional geopolitical struggle between the US and China. However, the United States and China are not the only big digital players in the world. As governments experiment, innovate and share their policy experiences and practices, there has been a proliferation of policy and regulatory models, and international internet governance is up for grabs.

Data governance is a contentious issue since it is becoming increasingly important to next-generation industries and the global economy's regulation future. South Korea and India, for example, have created unique national approaches to data governance. Neither country, much less China, aspires to replicate or adopt entirely American or Chinese data policies and practices. They, too, have the potential to fuel discussions about technological business models and regulatory frameworks.

Korea, in particular, is a digital trailblazer because it is arguably the most connected country on the planet. Indeed, because Korea is such a technologically advanced country, studying its rules and regulations in greater depth might reveal a lot. It is frequently listed as one of the world's most innovative economies, and the country's ability to create and adopt sophisticated technology domestically has been proved by the successful deployment of 5G networks and the development of smart cities. South Korea's innovation environment is boosted by a data privacy framework, which includes the Personal Information Protection Act and other legislation, that is seen as enabling creative big data applications while also offering robust privacy protections for individuals. South Korea's experience and viewpoints could thus be useful in informing bigger initiatives to improve data governance in the Indo-Pacific region.

Unfortunately, few people are aware of Korea's digital laws, in part because nothing has been written in English regarding the country's unique frameworks, standards, and models. Nonetheless, Korea has pioneered major methods to data governance over the last two decades, accumulating a body of experience with best practices—and occasionally not-so-great practices—that it has had to adapt, change, or replace. These encounters can be used to arrive at several valuable insights.

This research examines the Korean approach to data, with the goal of determining what can and should be learned from creative Korean policies and practices. It shows how the Korean government has attempted to develop coherent and uniform rules in three key data-related areas: online authentication and data access control, cyber defence and data resilience, and data localization. Korean policies have evolved by trial and error in each circumstance. Various ways have been attempted. When these methods were shown to be ineffective, more practical alternatives were devised.

The resulting frameworks could resonate widely with countries grappling with these three concerns. The escalating trade war between the United States and China is resulting in trade disputes, limitations on foreign investment, and, increasingly, blanket bans on the use of foreign web services and apps. Korea, on the other hand, has pioneered its own distinct approach to technology administration and regulation. Korea could provide a third option, based on practices and experiences established and fostered in a successful democracy that has also carved out a significant role for the state and sought a balance between public and private interests, as well as state and market-based initiatives.

Korean Policies on Cybersecurity and Data Resilience

The advent of information technology is a revolution and has been changing the world with its extensive and efficacious nature. South Korea is one of the leading drivers of this digital growth. However, this also makes them vulnerable to cyber threats, especially due to the political issues with neighbouring North Korea. Korea has been a divided country for more than sixty years, and North Korea, the Republic of Korea's neighbour, is a prominent online negative actor. This has increased the importance of ROK's online authentication and data access control policy and execution.

South Korea has been a highly digitized country with most government services available as e-governance models. Adding to that, the private sector has been a leading player in the world of technology. Over the years, the country has put in efforts in various directions to safeguard itself by developing comprehensive cybersecurity policies for both the government and private players.

<u>Early Efforts</u>

The programme for improving the digital infrastructure and inculcating it in government and the economy's systems began in the 1980s. Government services were encouraged to be shifted to digital platforms for better transparency and ease of access. The Korean government began towards the direction of comprehensive and nationwide cybersecurity in the late 2000s and published a national cybersecurity strategy in 2009. Various multilateral efforts were also made resulting in "The Seoul Declaration, 2008" (OECD) and "The Seoul Framework and Guidelines for an Open and Secure Cyberspace, 2013" among others.

<u>Cybersecurity Governance & the National Cybersecurity Strategy</u>

The Korean stance on cybersecurity eventually shifted from just countermeasures to propounding a piece of the government machinery. Three major agencies are involved in this namely: - The National Cybersecurity Center (NCSC), Cyber Command (It is established under the Ministry of National Defence and provides cybersecurity governance to the defence sector) and Ministry of Science and ICT (which deals with the cybersecurity matters of the private sector)

Since 2015, all three agencies have been inducted into the National Security Council which reports directly to the President. The government played an indispensable role in bringing these changes further in the private sector and the cybersecurity framework enables the government to do the same.
For instance, the NCSC operates a National Cyber Threat Information sharing system. Another important regulation is the Critical Information Infrastructure Act of 2001, which established an empowered committee to coordinate with the protection of critical information infrastructure.

This act has resulted in the designation of the commercial banks, transportation services, nuclear power plants systems and other essential networks as "Critical Information Infrastructure". The National Cybersecurity Strategy was published in 2019 by the National Security Office. This document is considered one of the most important policy documents on this matter and clearly defines six strategic pillars for attaining the goal of national cyber-security: -

• Secured National Critical Infrastructure
• Enhanced Cyber-Attack Defence Capabilities
• Trust- and Cooperation- based Governance
• Cybersecurity Industry Growth
• Fostering a Cybersecurity Culture
• Strengthened International Cooperation

These strategic pillars were followed by the National Cybersecurity Basic Plan which is segregated into policy tasks and technological tasks. The policy tasks include tasks like international collaborations, norm-setting, critical information infrastructure protection, crisis management and information sharing, while technological tasks include setting up adequate technology.

It is important to note that South Korea has formulated a systematic approach to cybersecurity by designating different agencies to some sectors and also categorically explaining the tasks they have to complete. Each agency has to maintain an implementation report as well as the tasks assigned by the national plan.

The revision of the National Intelligence Service Act has provided autonomy to the NCSC to use its resources strategically. For instance, the National Security Research Institute was designated as a research-and-development (R&D) specialized institution for cybersecurity affairs to expand its work to develop the strategies, policies, and technologies necessary to improve cybersecurity.

The Korea Global Cyber Security Capability Assessment and Applicability

Korea has developed a tool to make basic data available for cyber-related decision-making - Korea Global Cybersecurity Capability Assessment.

Its main purpose was to assess the cybersecurity mechanisms in the country and further suggest measures in order to strengthen the mechanism of cybersecurity. However, the scope of this body's activity has grown throughout time, and it now includes assists in information exchange, increasing awareness, and forging worldwide cooperation. Expert surveys are used to conduct the evaluation, which includes seventeen assessment criteria divided into five categories: policy, legislation, organisation, technology, and education/training.

Online Authentication and Data Access Control in Korea

This era has been aligned with ICT and is integrating at an unprecedented pace. The pandemic induced necessity of physical distancing has further bolstered its use, especially in technologically advanced countries like South Korea. New concepts like that of "untact" services (non-contact) have come up. In the time of the world being a global village, the use of ICT is indispensable and allows individuals to connect, exchange information and collaborate with negligible time gaps.

Access to these services however require personal authentication which is a major challenge for governments, ICT professionals and users to overcome. The process of authentication must be both safe and easy, balancing which is unequivocally essential. Loopholes in such processes might lead to cybercrimes like theft of personal data and confidential business information. It can be a big threat to intellectual property rights, which necessitates the strengthening of cybersecurity as well as the development of safe and easy online authentication platforms. South Korea has a high level of threat from its neighbouring country and many cyberattacks have been launched to date. This has made online authentication and data access control even more vulnerable in the country.

Online Identification

South Korea is a technologically advanced country and had started the informatization process very early, in the 1980s. Therefore, the online services began early too which necessitated online identification.
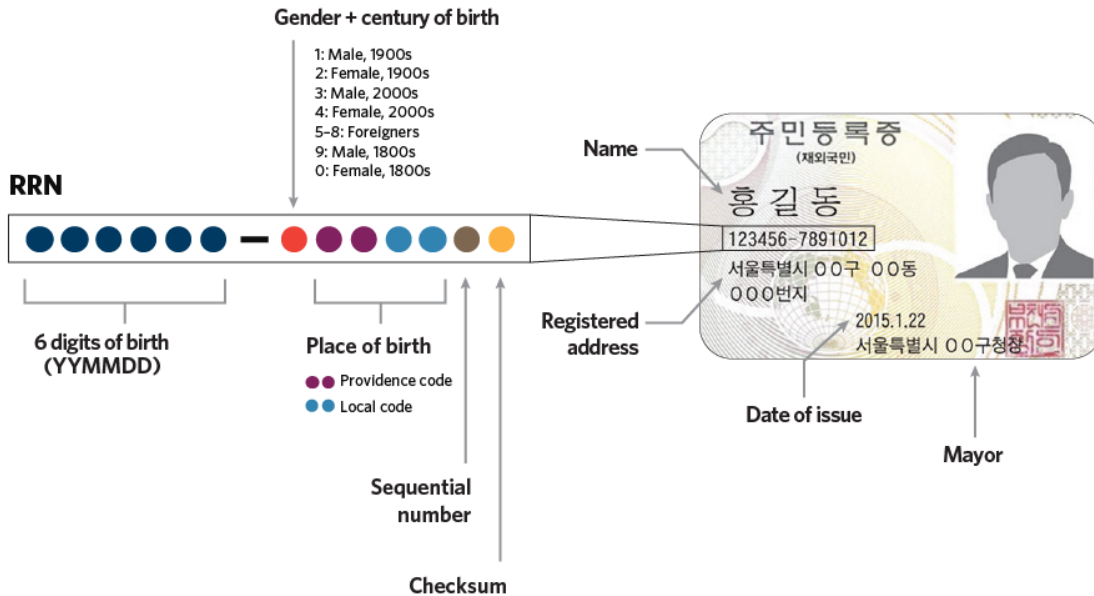
- ### Resident Registration Number

The RRN is a unique identification number that is provided to all Koreans and is used as identification proof. A Resident Registration Card (RRC) is the card linked to one's RRN is the valid proof of identification in South Korea. An RRC is issued to all citizens over seventeen years of age. In the early 2000s, RRN was used for online identification despite private websites not being legally mandated to do so.

Excessive collection of RRNs online brought the risk level of theft of personal data significantly higher. From 2003-04, new substitutes of RRN were launched to discourage the use of RRN and finally, in 2012, the collection of RRNs online was banned and regulations were drafted and implemented which provided exceptions for the use of RRNs for e-government services,

financial transactions, medical verification etc. In cases of exposure of personal data via RRN, a reissue was also allowed.

Figure 1. Resident Registration Number and Resident Registration Card of Korea

● Internet Personal Identification Number

The Korean government built and distributed an Internet Personal Identification Number (I-PIN) system as an alternate form of identification due to the possibility of data breaches and the careless gathering and use of RRN data.

An I-PIN 2.0 system was introduced in the year 2010 which improves the security level of personal information by issuing 88-byte connecting information (C.I.), by encrypting the RRN. All public identification services established after 2012 use this CI in order to safeguard personal information by restricting exposure of RRN. In addition to that, a random thirteen-digit identification number is also derived from the I-PIN for offline identity verification and is termed as MyPin. Additional security measures like CAPTCHA were also required for the usage of I-PIN.

Despite all these measures a public I-PIN was hacked in 2015 and led to 750,000 fraudulent issuances. After the hack new security measures were added – all I-PINs had to be renewed annually, additional authentication was required by secondary password, key pattern and biometric authentication. With the increasing complexity of the usage of I-PIN, the demand reduced and ultimately resulted in the termination of the regime in 2021.

- National Public Key Infrastructure – based Authorized Certificate

As previously stated, since internet usage and technology convergence increased, many features such as e-commerce, OTT platforms, and E-government services arose. To connect these services between the user and the provider, a secure authentication method was required. Korea has a legislative and institutional framework that includes laws such as the Electronic Signature Act and the E-Government Act, among others. These laws gave electronic signatures legal status and provided a framework for assessing and authenticating them.

In an online setting, public key infrastructure (PKI) is a technology that is used to implement digital certificates or public-key encryption. Although public key infrastructure (PKI) is a commonly used technology, Korea created a national PKI to provide a reliable authentication method that could be utilised in a range of circumstances. It is distinguished by the compulsion to use it in electronic financial transactions and E-government activities. The KISA and five commercial entities authorised as certificate authority issued certificates under Korea's NPKI system. When a site requests an NPKI issued AC, it is instantly saved in the Computer and authenticated by inserting a private key. From roughly 10,000 in 2004 to more than 40,000 in 2019, the number of NPKI-CA has expanded dramatically.

Data Access Control

Big data can be used to analyse different aspects of the population and can be beneficial to society and the economy by providing relevant information and landmarks for policymakers and other stakeholders. However, it can also be misused and result in violation of privacy, unfair sales techniques etc.

- Public Data

Public data was managed by the government and could be disclosed through public requests made to the concerned authorities. However, with the coming up of smartphones and new apps, public data was required for basic workings and thus, the government began the private use of public information. IT systems maintained by the government got investment from the government and cloud-based administrative information infrastructure was laid down. The government has made efforts in open utilization of public data by establishing various bodies for

researching policy frameworks for the same. Recently in February 2021, the government established the "Data 119 Project" and announced a data strategy to revitalize the digital economy by promoting open data utilization.

- Private Data

The use of personal information in the private sector has been a contentious issue worldwide. Korea has adopted the EU model of regulating this. The Korean government enacted legislation called the Personal Information Protection Act (PIPA) in 2011. Any information by itself or by combination with any other information that can identify the person linked is considered personal information in PIPA and its use by private players is strictly restricted.

Therefore, the involvement of data in Korea is relatively very less to countries like the United States. according to the Korea Data Industry Promotion Agency, the size of the Korean data markets as of 2017 was $443 million, which was only 0.25 per cent of the U.S. market ($177 billion)

The ICT Environment in Korea

Information and communications technology (ICT) is an umbrella term that encompasses any communication device, computer and network hardware, satellite systems; ostensibly information technology that emphasises communication. With some of the fastest internet connections, widespread digital payment systems (even prior to the pandemic), and the government's digital-first approach; Korea has gained a reputation as a 21st century ICT hub. Boasting world leaders in various tech-related fields, Korea is home to Samsung, LG and KT. Its rapid transformation from one of the poorest countries in the world in the 1950s to one of the richest today is in no small part from decades of government and private investment in modernisation.

There is a lot of empirical evidence on the causal relationship between the development of ICT and national economic growth.
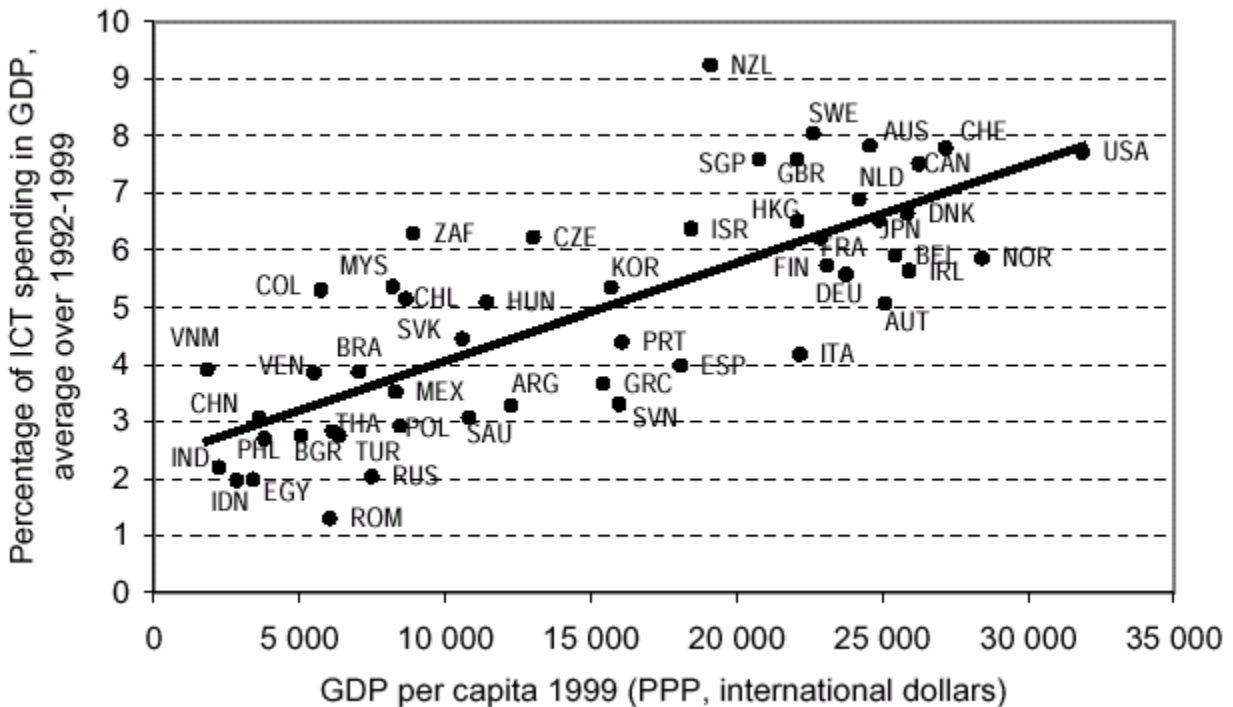
South Korea leads the world in broadband and mobile networks by which 98.8 per cent of households can access the internet as of July 2015. In terms of hardware ICT products, the Republic of Korea is either a significant or dominant player in the production of lithium batteries, LCD panels, handsets, semiconductors. A recent paper found that in the period between 2007 and 2011, the production in the Korean ICT industry increased by 8.8% annually, whereas average growth in the global market was 3.6% during the same period. In terms of rankings, the International Telecommunications Union and World Economic Forum both rank Korea among the top. It accounts for the biggest proportion of its exports in value. The ICT
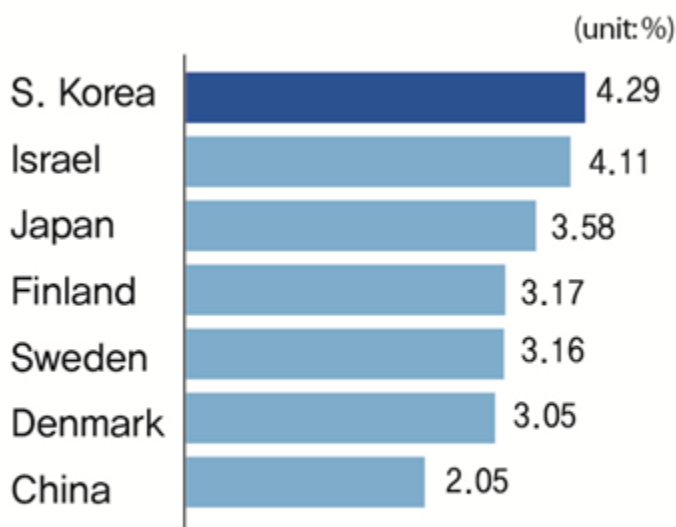
industry in Korea is characterised more by manufacturing as opposed to services in comparable developed countries. Their industrial policy also tries to address hardware concerns more relative to a focus on intellectual property and intangibles.

The success of this industry is rooted in intensive investment in public infrastructure, direct support to the ICT industry, competition-based industrial structures and other such policies. The government shifted from a focus on heavy industry to industrial policy focussed on ICT with the Masterplan for Development of Electric Industry. The government continues to release a National ICT Infrastructure Master Plan on a yearly basis under the Korean Ministry of Information and Communication, which attempts to provide coherent direction to state efforts, regulation and assimilation of ICT concerns in all aspects of policy.

An important feature of Korean industrial policy is the direct state involvement in research. The government incentivises research and development through both the tax structure and, more importantly, directly through research done at institutes funded by the government. The government has established places like the Korea Institute of Science and Technology (KIST) and the Electronics and Telecommunications Research Institute (ETRI) which have been critical to cutting edge research. It has partnered with universities to develop projects like the Korean Advanced Institute of Science and Technology. These institutes provided a base for the industry's development in its nascent stages and now serve as an incubation hub for sophisticated research.

The government spends enormous amounts to build and maintain public infrastructure conducive to the industry. The near-universal adoption of high-speed internet and broadband (much earlier than other economies) can be attributed directly to government efforts. Infrastructure investment, in this context, also involves setting up and accelerating collaboration between national labs, government agencies and business entities. Importantly, the government's plans are not just for speeches but have been reflected in where the industry has concentrated spending in different stages (for example national networks in the early 2000s). It has harmonised the roll-out of new technologies by standardising practices in the industry which companies like Samsung and LG have taken advantage of at home.

R&D Ratio to GDP by Country

(unit: %)

Country	R&D Ratio
S. Korea	4.29
Israel	4.11
Japan	3.58
Finland	3.17
Sweden	3.16
Denmark	3.05
China	2.05

Despite heavy state involvement, the government has encouraged the industry to face market competition.

It has privatised important utilities like Korea Telecom and gradually deregulated large parts of the industry to encourage competition by lowering barriers to entry.

State efforts are also not limited only to core ICT functions but are oriented towards a more holistic view of the market. As the industry converges with other key parts of the economy like automobiles, textiles, education and health; state involvement has grown to stimulate further collaboration and interdependence.

Artificial Intelligence

From 2016 onwards, the government has defined a formal Artificial Intelligence Information Industry Development Strategy under the Korean Ministry of Science, ICT and Future Planning which considers the burgeoning industry both comprehensively and in terms of future convergence with other technologies. It has continued to pursue a mixed balance of government research and strategic public-private partnerships towards this end of achieving industrial competitiveness and has invested upwards of $863 million in the field over the past five years. This was followed by a "National Plan for Artificial Intelligence" in late 2019. The report found a shortage of AI engineers in the country and the Korean government plans to create at least six new AI schools by 2020. However, the Korean legal system is not fully equipped to handle shifts in issues like copyright protection and data rights that might arise in AI might engender.

People involved in Artificial Intelligence have also raised concerns about anti-trust issues at the interface of big data and AI since there is no current government strategy to address such concerns about ownership and utilisation of data in an AI and machine-learning led environment. Chatbots driven by AI have become commonplace: they're used by the Ministry of Justice for quickly addressing legal enquiries as well as for teaching kids.

In 2021, Korea made headlines for sanctioning the AI company responsible for the chatbot "Iruda". The chatbot was built on data that was not properly obtained from dating and messaging apps and this was the first such case of the law being invoked against a chatbot service. The lack of a well-developed venture capital ecosystem that has facilitated investment in AI technology in other countries has limited South Korea's potential beyond the big conglomerates and government spending. During the pandemic, South Korean biotech firms were the first ones to use AI to assist in the diagnosis and risk assessment of patients

Cloud Computing

Cloud computing is the on-demand access, through the internet, to computing resources: applications, servers, data storage, development tools, networking capabilities that are hosted at a remote data centre managed by a cloud services provider (or CSP). In recent years, it has revolutionised data management in companies across the economy by minimising IT costs and improving scalability. The government published its first blueprint for the promotion of the cloud computing industry in 2015.

The Korean cloud computing market is dominated by global leaders like Amazon Web Services, Microsoft Azure, Google Cloud, IBM Cloud. Local giants like KT and SK have also launched their cloud service providers as well. The South Korean cloud computing market was predicted to reach $2.4B by 2020. For promoting this industry, the state has enacted the Act on the Development of Cloud Computing and Protection of its Users.

Fig 19. Korea: public cloud computing market outlook
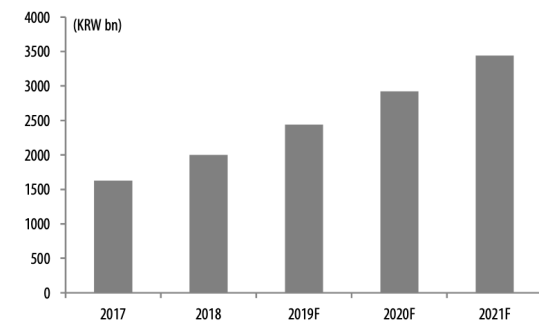
Source: Gartner, media reports

Fig 14. Global: public cloud computing market outlook
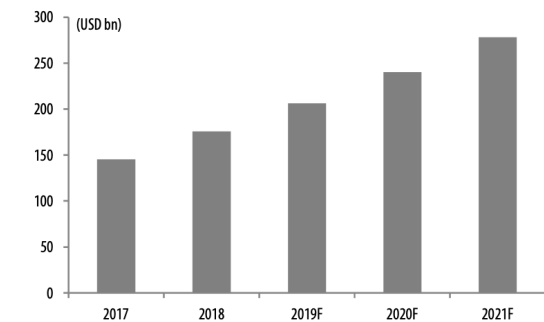
Source: Gartner, media reports

Experts suggest that they should provide tax incentives along with fiscal and technical support to smaller and medium-sized firms in adopting cloud computing. In 2020, the government announced that it would introduce cloud computing to the entire public sector. An older piece of legislation that restricted public sector usage of cloud computing was repealed. Public agencies need to consider cloud computing first whenever they develop new systems. The older systems will be transitioned to cloud computing
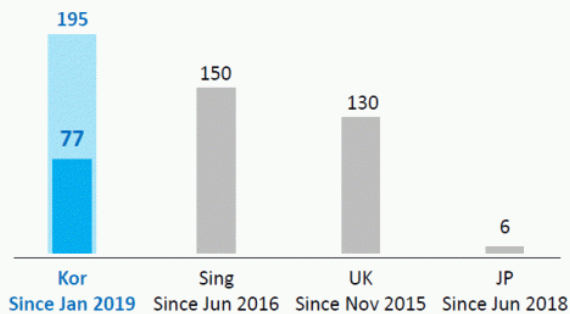
Fintech

Fintech or Financial technology refers to businesses that use modern technology to automate or enhance financial transactions. Supported by robust digital and financial infrastructure, the fintech industry has seen a boom in recent years with ever-increasing investments.

As per a government report, the rate of fintech adoption in South Korea reached 67 per cent of the digitally active adult population in 2019. The government tries to provide a dynamic regulatory environment that adapts to the needs of the rapidly changing field. The South Korean Financial Services Commission has launched a regulatory toolbox for fintech firms.

3. Financial Regulatory Sandbox & financial innovation

> The *Sandbox* has *accelerated innovation*, enhancing benefits and lowering costs

Late starter but fast runner

195	
77	

Kor	Sing	UK	JP
Since Jan 2019	Since Jun 2016	Since Nov 2015	Since Jun 2018

150 — Sing
130 — UK
6 — JP

Among 77 approvals,
26 services are in operation

Everyday finance	✓	On-off insurance
	✓	Deferred money transfer
New technology	✓	AI-based consulting
	✓	Face ID
Financial inclusion	✓	Various financial services for small biz owners (e.g., QR code, credit rating)
ESG	✓	P2P finance for ESG projects
	✓	Preventing voice phishing

This allows fintech start-ups to trial their products and interact with the participating consumers and provides the regulator with experience and insight into the industry. Beyond pilot programmes, they also provide assistance to products in the early stages of development. As one of the leading e-commerce markets, the coverage and density of online financial transactions have expanded quickly. In 2018, digital payments accounted for a daily 1.14 trillion won in transactions with Naver and Kakao being the leading business. Viva Republica, another fintech firm that operates a comprehensive financial services provider called Toss became the first fintech unicorn and was valued at $7.4 billion as of July 2021.

The fintech industry is currently handicapped by the legacy incumbent banks who control more than 40% of banking services but haven't fully transitioned into digital service providers. As such, there is still a significant segment of consumers who haven't adopted fintech products. Industry professionals believe that fintech firms should be encouraged to go abroad to seek larger markets to expand their reach. Moreover, the government should aim at diversifying funding for such start-ups through FintechBridge agreements like the one with the UK to support the inflow of capital into the industry.

<u>Smart Healthcare</u>

In the last couple of years, Korea's leading telecoms operators SKT and KT have announced plans to play in digital healthcare, formed partnerships with enterprises, universities and hospitals. Unfortunately, the law prohibits telemedicine. This policy was relaxed in response to covid but has severely impacted the development of direct digital healthcare services. It has impeded the launch of virtual consultation apps and the like, which are prominent

consumer-facing services available in other countries. Mobile healthcare apps need authorisation which is rarely granted. The Korean government's time-consuming approval of innovative devices has been much criticised. Mobile ECG apps and readers which have become commonplace elsewhere were launched much later in Korea. Moreover, the nationalised healthcare system doesn't set high reimbursement rates for digital products which have hindered their adoption. Although some AI-linked devices have received a license, they aren't eligible for insurance coverage. Stagnant and excessive regulation has held the industry back.

Ultimately, while government-led efforts have enjoyed extraordinary success in the trajectory of the Korean ICT industry, it is time for the state to re-orient its focus toward software and technology at the forefront of global markets. It needs to rethink its dependence on hardware related industrial policy and attempt to galvanise a software cluster and development. Furthermore, it must acknowledge that the lightning-fast rate of change in modern technology leads to new economic and social practices being led by commercial players as technological advancement outpaces government policy responses.

Data Localisation

Data Localisation refers to laws that mandate that data about a country's citizens need to be stored/ collected/ processed locally before it can be transferred internationally. The amount of data collected digitally seems to be growing exponentially and intellectual property and privacy laws surrounding the data remains murky. Hence, the ascendance of Data Localisation rules. The guiding objective behind such laws can be diverse: from cybersecurity concerns to privacy laws to domestic development or a combination of these.

The primary purpose behind South Korea's set of laws is to ensure the enforceability of its regulations on data collection. The most relevant legislation here is the Personal Information Protection Act (PIPA) which restricts the ways in which data can be utilised and collected from private citizens as well as the Act on the Protection of Location Information & Korean Land Survey Act which deals with collection and usage of geographical concerns. The latter is most important from a national security point-of-view since the spectre of North Korea looms large in the minds of South Korean leaders. The obvious downside of such regulation is that while restriction of data flows allows for better enforcement of domestic regulation, it definitionally limits trade and poses questions about how that data is being secured. Digital trade and cross-border data flows are predicted to continue to grow faster than the overall rate of global trade.

The Personal Information Protection Act (PIPA) aims to strengthen Korean people' privacy rights and protections. It has broad authority and imposes restrictions on the collection, use, storage,

outsourcing, and provision of personal data. There was no single law that covered both public and private organisations prior to its introduction in 2011. It also broadened the definition of data protection beyond telecommunications companies. The act mandates that "data subjects" be informed of who receives their data, the recipient's reason for possessing it, the length of time it will be kept, and the precise personal details that must be provided. The Korea Communications Commission (KCC) penalised Google $212 million in January 2014 for breaking these guidelines.

The Korean Land Survey Act essentially places restrictions on taking maps, photos, the results of a survey, or any land surveillance of South Korean abroad. This was enacted to protect the country's security interests in a volatile neighbourhood. Originally enforced for physical items, it's been used to restrict digital data transfers and usage. Google was denied permission in 2016 to use Korean map data. The authorities agreed to grant an export license if data on sensitive areas was redacted but that plan was rejected by the company. Since the original complaint was about unfair treatment of foreign companies, the government claimed that domestic companies also operate under a similar framework and this should be satisfactory. The Act on the Protection of Location Information, on the other hand, deals with the location data of individuals and restricts the collection or use of such data without obtaining the individual's consent.

The evolving legal regime in Korea also reflects global guidelines mentioned in international documents like that of the OECD as well as foreign laws like the European Union's General Data Protection Regulation. In fact, there is a dialogue between the two regulatory regimes for coordination of corresponding legislation and mutual recognition of the adequacy of data protection rules of each party. As such, it is expected that European authorities will soon grant that Korean data protection rules are robust enough to allow mutual export and import of data between the two. This will facilitate the data transfers and should encourage trade.

The main drawback of such policies is that much of the value derived from data comes from its comprehensiveness and diversity, which are obviously hampered by restrictions on trade flows. The costs of these policies are significant, not just for the Korean economy but for the global economy. Due to the globalised operations of foreign firms, it clearly disadvantages foreign firms. Worse, while tech giants like Google can deal with the cumbersome regulatory burdens and employ high-quality legal resources; this is not easy for small and medium-sized companies. Compliance costs raise the barrier to entry for such firms.

Some cybersecurity experts believe that such laws are extremely ineffective at bolstering security and privacy. They suggest that the idea that data is more private and secure when it is stored within a country's borders is simply false, though it is widely believed by politicians drafting such regulations. Companies that have a physical and legal presence in Korea have to abide by their data collection laws regardless of whether they wish to operate. Companies that don't have a physical presence can't actually be regulated by Korean authorities since they don't have

jurisdiction. There is no real change in data security unless they somehow just ban such websites which is not exactly feasible. Fundamentally, in the case of inadvertent disclosures of data, if the country has a legal presence in the company; the company is subject to Korean laws anyway. It doesn't matter where the data is stored. It could be stored in Ireland but if Koreans' data was compromised, the company could be held liable if it's operating in Korea. The fact is that the vast majority of the companies who might be collecting information from Koreans have operations in Korea. Importantly, security breaches can happen wherever data is stored—data centres everywhere are exposed to similar risks. What is important is that the company involved is dedicated to implementing the most advanced methods to prevent such attacks. The location is irrelevant. A secure server in Argentina is no different from a secure server in Korea. It is the technical, physical, and administrative controls that matter. Moreover, such laws restrict the growing industry of cloud computing, which strengthens the data security of small and medium-sized firms which can now outsource their data storage and management to globally competitive service providers like Amazon and Microsoft.

To the extent that they act like protectionist measures for the digital economy, such laws don't provide any economic benefits. They may affect the location of data centres but those are not responsible for a lot of employment nor are they a catalyst for other technologies. There is not much gained economically from restricting them domestically and it certainly does not outweigh the increased cost of digital processing that is borne by all companies engaged in data storage and collection. According to a study done by the US International trade commission, most firms consider data localisation requirements to be expensive, time-consuming, and disruptive and this was especially true for smaller firms. For Korean firms, barriers to data flows make firms less competitive as the company is forced to spend more than necessary on IT services due to higher data processing costs and a more complex regulatory framework. The economic impact ripples throughout the economy as barriers to data flows affect data processing and Internet services—or any service that depends on the use of data for delivery. A report by Leviathan found that similar regulation being pursued in Brazil would have raised the cost of cloud computing by 54%.

Such restrictions could limit the adoption of cutting-edge technology like IBM's Watson- a supercomputer/ AI- that work on the collection of vast amounts of data from different sectors across the world. Building such devices needs data centres that might be impeded in usage by barriers to data flows.

Korea needs both stronger data protection within its borders that actually impacts privacy and freer cross-border data flows. The government should utilise the reciprocity principle present in the laws that discourage the restriction of the cross-border flows of personal information if the other countries have secure regulation. At a minimum, this should boost the data flows that are undoubtedly secure, as per its own standards

Korea's Success with 5G and the Korean New Deal

As we have stepped into the virtual world heading towards the fourth industrial revolution and the world's power dynamics are changing with the respect to the higher importance being acquired by cyberspace, power and prowess, the 5G services seem to be becoming the new driver of this change worldwide. While the erstwhile superpowers like the USA and China claim to have developed and deployed the 5G services, many of the developing nations also seem to be setting foot in this direction. The critical infrastructure that will shape national competitiveness is a fifth-generation wireless technology for digital cellular networks. 5G is anticipated to produce $12.33 trillion in revenue and 22 million employment opportunities around the world. It will support haptic applications that demand human-like responses, such as telesurgery, due to its quicker speed, bigger data capacity, and near-zero ping time. While 5G will aid in the Fourth Industrial Revolution, fully realising the technology's potential to change all sectors of the economy would necessitate a paradigm shift, the most significant component of which is the identification of 5G as a vital national infrastructure for all countries.

Preparedness for fourth industrial revolution

(Ranking among 139 countries)

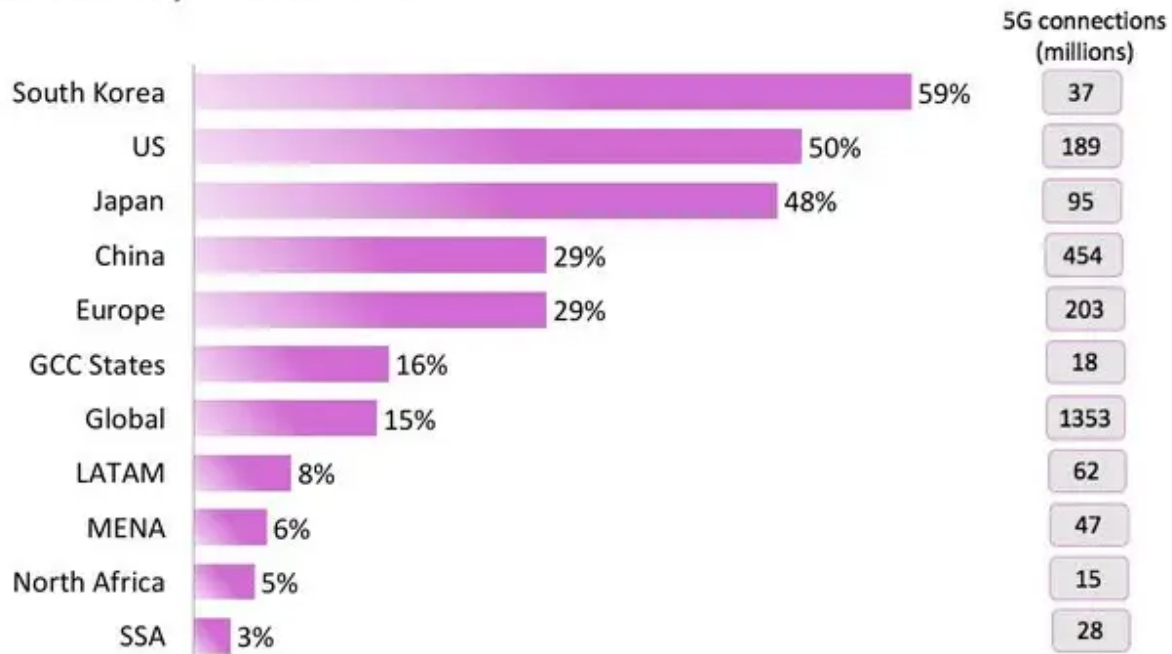|	
US	5th
Japan	12th
Germany	13th
South Korea	**25th**
China	28th

Source: WEF

When we talk about technological innovations and progress, the mention of South Korea seems to be a must. South Korea has left an indelible mark on the world with its development in multiple fields in such a short period of time, big data being the most remarkable one. Korea launched the world's first smartphone-based, business-to-consumer (B2C) 5G commercial services in April 2019. In just two years, the number of 5G customers in the country topped 13 million, accounting for 20% of all mobile subscriptions.

5G is still in its early stages of development globally, both in terms of market and technology. Korea, on the other hand, is one of the few countries to have achieved early success in scaling up a domestic network and developing a complete national strategy to exploit 5G's disruptive potential. The country's experience demonstrates that, even in nations with mature mobile industries, the government's role as a major enabler for the development of the 5G ecosystem is still vital. The country's key 5G successes to date—including the world's first simultaneous 5G spectrum auction of the 3.5 GHz and 28 GHz bands, the world's first B2C smartphone-based

commercial launch, and surpassing 13 million subscribers in just two years since the service launch—are largely due to close collaboration between the government and multi-stakeholders.

South Korea Set To Lead 5G Adoption By 2025
5G as a share of total connections

	5G as a share of total connections	5G connections (millions)
South Korea	59%	37
US	50%	189
Japan	48%	95
China	29%	454
Europe	29%	203
GCC States	16%	18
Global	15%	1353
LATAM	8%	62
MENA	6%	47
North Africa	5%	15
SSA	3%	28

Source: GSMA, 2019

The Korean government had been quick and farsighted in realizing the pivotal role that Information and Communication Technology will play in the shaping of the world and proved this wilfully by recognising the importance of 5G as the driving force behind the 4Th Industrial Revolution. In May 2013, the government launched the 5G Forum to initiate formal discussions on the national 5G strategy and readiness, drawing members from public institutions and the private sector. With the establishment of the Presidential Committee on the 4th Industrial Revolution (November 2017), the government declared 5G as one of the three keys to the fourth industrial revolution, Data, Network, and AI (DNA). Since then, the government has significantly expanded its support for DNA, announcing various policies including I-Korea 4.0 Plan (2017); HyperConnected Intelligent Network Deployment Strategy (2017); AI R&D Strategy (2018); Data Industry Activation Strategy (2018); System Semiconductor Strategy (2019); 5G+ Strategy (2019); Manufacturing Renaissance Strategy (2019); and the Korean New Deal (2020).

Investments in numerous disciplines were critical to making progress and achieving success in the field. A crucial cause and lesson to take from the Korean model is the government's multiple policy initiatives that have resulted in public-private partnerships. All three major Korean mobile network operators (MNOs), SK Telecom, KT, and LGU+, have been actively investing in 5G networks since the debut of business-to-consumer (B2C) 5G commercial services in April 2019, with the goal of completing the national deployment by 2022. In 2019, MNOs invested KRW 9.6 trillion (approximately USD 7.8 billion), up about 50 per cent from the previous year, to build 3.5 GHz-band base stations. In 2020, the investment dropped to KRW 8.28 trillion (approximately USD 7.4 billion), 7–8 per cent short of the initial target, due to the impact of COVID-19. The Ministry of Science and ICT (MSIT) projects that, at minimum, KRW 8.3 trillion annual investment is needed until 2023 to adequately meet the national deployment target by 2022 and make up for the investment slowdown caused by COVID-19. To encourage investment and speed up network deployment, the government is offering a 3 per cent tax credit for 5G investments with an additional 3 per cent tax credit for the increase over the average of the previous three years' investment.

Another key factor for the successful implementation of its 5G service plans has been the government's transparent, proactive, and long-term focused spectrum planning since 2010.

Last but not least the hidden yet obvious reason for Korea's success with 5G remains its consistency and continued emphasis on Research and Development and its glorious aspirations. Less than a week after the 5G commercial launch, the government unveiled the 5G+ Strategy. The 5G+ Strategy sets out the government's ambition for Korea as a global leader in 5G technology and the steps it will take to realize this goal. The 5G+ Strategy includes specific policies and measures to support ten strategic 5G-related industries and five core services to transform the economy.

South Korea announced the Korean New Deal in July 2020 with an ambition to enhance its institutional infrastructure with special emphasis on the need and development of big data in the post covid world. With this announcement, Korea outlined its national strategy with the vision to create a smart, green, and inclusive country with 5G as a crucial underpinning infrastructure for a data and innovation-driven economy. The Korean New Deal, which was announced on July 14 in Korea, aims to invest 160 trillion won (114.1 trillion won in fiscal investment) by 2025 to create 1,901,000 jobs, based on two main policies – the Digital New Deal and the Green New Deal – as well as overarching policy support to strengthen employment and the social safety net.

Breakdown of Moon's K-New Deal
(In percent)

Employment safety net

Green new deal

17.8

Total
160 trillion won

45.9

36.4
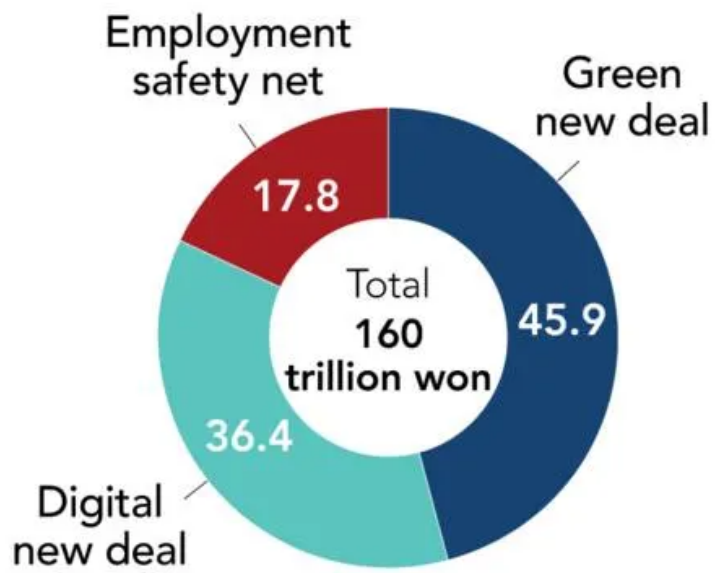
Digital new deal

Figures do not add up to 100 due to rounding
Source: South Korean government

Under the Digital New Deal, the government announced plans to invest 58.2 trillion won (44.8 trillion won from the treasury) to support the creation of 903,000 jobs. With the aim to accelerate the transition towards a digital economy, the investment will focus on the integration of data, network and AI (DNA) throughout the economy (31.9 trillion won from the treasury), promoting the 'intact industry (2.1 trillion won from the treasury), and digitalizing the social overhead capital (10 trillion won from the treasury).

The following are the goals set forth by the government for the Digital New Deal:
- Enhanced data, network, and artificial intelligence integration across the economy
- Infrastructure for education is to be digitalized.
- Fostering the "untact" industry, which includes assisting microbusinesses' internet activities and encouraging SMEs to work from home.
- SOC (Social overhead capital) digitalization entails incorporating digital technologies into urban environments as well as developing smart logistics and distribution systems.

By 2025, the Green New Deal seeks to invest KRW 73.4 trillion in sectors like climate change responses, green infrastructure, renewable energy, and green businesses, with the goal of creating 659,000 jobs. Investment in human resources has also been identified as a priority is given the transformative impact rapid technological change is having on existing economic structures. Investments will be made in human resources to build talent provide employment support for new types of jobs, and reduce the digital gap. In addition, strategies to improve rural residents' and vulnerable people's access to digital infrastructure would also be adopted. An ultrahigh-speed internet network will be built in 1,200 rural villages including islands and other

remote areas. In addition to the replacement of 18,000 old Wi-Fi equipment, 41,000 high-performance Wi-Fi equipment will be installed in public places such as community centres.

A newly established 'datadam' would allow the processing, trading and secure utilization of data. This will digitalize key industries of the country and create new markets. Based on digital technology such as blockchain and 5G, customized government services for different needs could be made available anywhere at any time thus digitalization would create jobs countering the unemployment issues. The digitalization of geographic data will create various types of new industries, and enable safe and convenient lifestyles through ICT and HomeServices. The establishment of 'untact' infrastructure will protect the country from external shocks including infectious diseases by ensuring a stable provision of medical services and a safe working environment for medical staff.

Hence, the Korean New Deal is expected to transform Korea into a smart country that leads the way for industrialists and innovative public services, a green country striving to maintain a balance among growth and nature and a safe country that protects against unemployment and disparities. With its tri-focussed approach Korea wants to set an example in the world of ICT by setting up an inclusive and sustainable data space that is not just motivated by profits but also fulfils its social and environmental obligations.

The Korean New Deal is a leap forward taken by Korea in the international panorama as it has set a trajectory for the world, especially the developing countries, to establish their digital presence in the world that can be achieved by an amalgamation of the following steps:
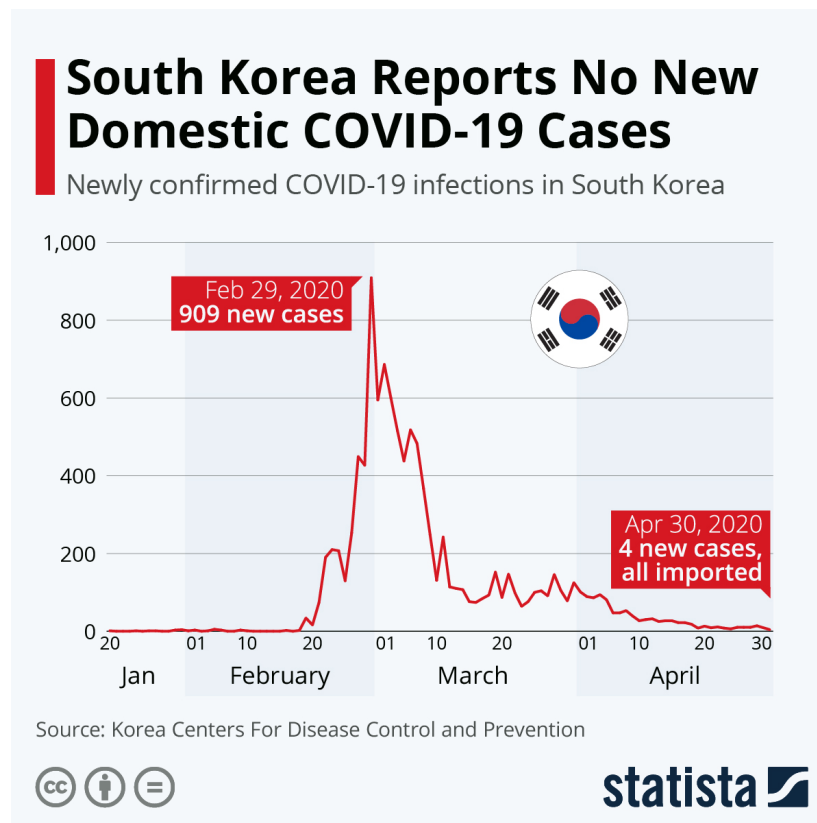
- Development of the National 5G vision and strategy to pave the way for private sector-led innovation and ecosystem development
- Institutional capacity building in spectrum management
- Timely assignment and provision of 5G spectrum
- Cross-ministerial collaboration, public-private partnerships and multi-stakeholder consensus building under the government leadership
- Supporting 5G trials and testbeds in the 5G strategic industries.
- Periodic assessments of progress and targets

Coronavirus

While Korea has been pursuing its ambitious programmes for the betterment of the country, the Coronavirus hit the country as a major blow in February 2020 as the country started reporting the highest number of infected cases after mainland China and the forecasts started predicting worst-case scenarios. However, to the awe of the world, Korea was able to flatten the curve in an

unthinkably short time period with its innovative approach. Korea was able to flatten the curve in 20 days with the application of Big Data, AI and SmartTech.

Smart Contract Tracing put to use the big data working at scale and brought actionable insights. The contact tracing app was based on different kinds of data like Geospatial, Time Series, Image and Video, Transactions and Others.

South Korea Reports No New Domestic COVID-19 Cases

Newly confirmed COVID-19 infections in South Korea

Feb 29, 2020
909 new cases

Apr 30, 2020
4 new cases, all imported

Source: Korea Centers For Disease Control and Prevention

statista ⬦

Information about the location was tracked through several sources and combined to obtain a comprehensive picture of a confirmed patient's movement which was shared publicly. The app gave information about the history, timeline, and location visited by the individual. When monitoring and analysing viral transmission, CCTV cameras were also frequently utilised. There were more than 1.1 million operational CCTV cameras in South Korea every day. Based on statistics from 2010, each citizen is captured by the public CCTV system on average of 83.1 times every day, and the trend has grown over the years.

Smart contact tracing reduced the reaction time of authorities to identify a potential threat, isolate transmitters of the virus, and notify everyone who might be in danger. The public app also informed the users of the status of areas they were visiting and activities of any other confirmed patient that was leading to transmission. The system also tracked the activity of the virus and helped hospitals and clinics to be better prepared. South Korea proved itself as a great example of how AI and Big Data could be applied for social good — reducing reaction time, increasing accuracy, and deploying solutions throughout the whole country. Privacy, data security, and information sharing were all areas of concern, but thanks to South Korea's transparent and consistent administration, culture, collective effort, technological sophistication, and drive to innovate, the country was able to overcome the threats.

The Role of Data in Driving Innovation for the Korean Economy

Korea has grown more than 10% annually between 2016 and 2020. Its rapid growth and development, accompanied by innovative and effective policies, can be attributed to its data industry. The government has designed favourable policies and built the appropriate infrastructure required to further its vision of "building a leading digital economy based on data innovation".

The key enabling factors for the exponential growth of data and thereby data-driven innovation (DDI) include:

1. Access to a fast and open internet - enabling the free flow of data
2. Sensors and sensor networks - enabling the datafication of the physical world
3. Machine-to-machine communication (M2M) - allows data to be exchanged in the internet of things.

1. Access to a fast and open internet - enabling the free flow of data

High-speed mobile broadband

The rapid infusion of broadband into the economy is one of the most fundamental enablers of DDI. The underlying infrastructure for the exchange and free flow of data is high-speed broadband. Nowadays, data is collected remotely through internet applications and smart and interconnected devices. Broadband networks enable timely data transmission where real-time applications are deployed. Mobile broadband, in particular, is critical, as mobile devices are increasingly being used to collect and disseminate data. Further, high-speed mobile broadband is important to improve connectivity in remote and less developed regions where DDI could bring much needed regional growth and development through effective practices that are backed by data.

There's a high penetration of affordable, high-speed broadband networks in Korea, with it being the world's most connected country. Almost 96% of adults had access to the internet in 2018. Also, the country boasts the world's highest 4G telecommunications availability and the highest fixed broadband upload speed.

It has invested heavily in ICT infrastructure as a national priority, building broadband networks and extending its reach into almost every home. With an average of more than 200 megabits per

second for fixed broadband speed, the country's broadband networks have created a powerful platform for innovation. The country's motivation for this has been to achieve some of the highest internet penetration in the world.

In 1999, a decision was made to spark competition between the two telecommunications companies that dominated the Korean network business then. This resulted in a market with 4 major and several smaller players, leading to higher competition and innovation. This, combined with the state funding for government networks and subsidies for rural broadband, led to one of the fastest and earliest build-outs of fixed broadband networks in the world. Today, Korean companies are among the world leaders in 5G wireless broadband.

For countries, broadband constitutes a necessary but not sufficient infrastructure condition for DDI.

Some other factors, such as local availability of data-driven services, along with the country's co-location and backhaul markets function, an open internet that enables non-discriminatory access and the free flow of data are important to ensure that DDI takes place.

Co-location and Backhaul Markets

An OECD study on "International Cables, Gateways, Backhaul and International Exchange Points" shows that the functioning of local markets for hosting and co-location affects where digital local content is hosted. The underlying assumption is that "if a larger portion of sides is hosted outside the country it could indicate that the local market for hosting and co-location is not functioning efficiently." The analysis of local content sites hosted within the countries shows that countries above the OECD average, for example, Korea, tend to conform to expectations that local content is hosted primarily within the country. The number of top sites hosted strongly correlates with the number of co-location data centres. This suggests that such countries will be the main destinations for global data flows on which DDI relies.

2. Sensors and sensor networks - enabling the datafication of the physical world

Seoul has implemented 'Based on data', one of the five innovation strategies, to achieve its smart city vision for energy and other sectors. The accumulation and analysis of urban patterns form the basis to achieve smart infrastructure, services and citizens. It started in 2011, with the integration of internal administrative datasets.

The following year the 'Open Data Plaza' was launched, giving third-party developers and researchers access to urban datasets from which new services and insights can be generated. A

big data platform and campus, the Digital Mayor's Office, and a real-time 'virtual population' are among the more recent efforts.

The data is generated for smart city innovations through the real-time sensing of various urban assets. Sensors deployed in Seoul include CCTV cameras and detectors measuring traffic flow, speed and air quality. By 2022, Seoul plans to place 50,000 more IoT sensors throughout the city to monitor fine dust, wind direction, noise, vibration, and floating population.

With smart cities producing enormous swaths of fresh data, making it publicly accessible to leverage the insight potential is critical. With 184 apps established thus far, Seoul's Open Data Plaza allows access to over 5,000 datasets, including real-time sensor data. By January 2019, the datasets had been accessed 6.9 billion times and included a wide range of topics in urban living, from health to housing.

The functionality of the website includes an API, mapping and visualization. The economic value of opening up this information has been estimated at USD 1.5 billion by the Korea Local R&D Institute.

SMG's own big data platform was utilised to find patterns and insights from massive datasets. Over the last seven years, 44 case studies indicating advantages have been developed. Three billion cell call records, for example, were analysed to discover late-night cab calls and create the routes and frequency of a new 'Owl Bus,' which caters to the demands of partygoers and shift workers while minimising traffic congestion.

3. Machine-to-machine communication - empowering data exchange in the internet of things

All devices such as phones, TVs, smart meters, and Internet-connected cars exchange data to communicate with each other, a process known as machine-to-machine communication (M2M). Innovative products based on M2M include, for example, smart meters that collect and transmit real-time data on energy and Internet-connected automobiles that are now able to transmit real-time data on the state of the car's components and environment. Many of these connected devices are based on sensor and actuator networks that sense and exchange data through wireless links enabling interaction between people, computers and the surrounding environment. These sensors can be recorded as the interface between the physical world and the world of electrical devices such as computers as they measure multiple physical properties.

Now, the data that is collected is not only used in the machine but is also shared more widely and combined with other data.

Now, Korea has taken up some other initiatives, as well, to build on its vision of "building a leading digital economy based on data innovation".

The Ministry of Science and ICT (MSIT) announced a strategic plan to build integrated public-private platforms that systematically collect accessible data sources and support their sustainable growth in markets. They aim to establish a sustainable, accessible, and integrated data innovation ecosystem across public and private sectors, which supports the full cycle of data processing, distribution, analysis, and utilization. Later on, the MSIT will enhance the 16 existing big data platforms -- that it has established in fields such as finance, environment, culture, healthcare, and agriculture since 2019 -- and integrate them into service-oriented platforms that are beneficial to the government, people, and businesses, by 2022. The MSIT also intends to establish new Big Data platforms in 15 major industry areas where data consumption is rapidly increasing by 2025. The project is also a part of Korea's Digital New Deal initiative.

To make it easier for anyone to track and access data from the platforms, metadata - data that provides basic information about other data - will be added to the nation's "Big Data Map." This will serve as a data pool that collects and processes the information provided by both public and private sectors to create useful data.

The so-called "data voucher system" will accelerate consumer-centric data distribution by supporting data consumers, including businesses, in data purchase or processing.

The benefits associated with the project include:

- Data from the private sector will also be more easily accessible to the government and public entities.
- The entire public-private procurement process, including bidding, contracting, and delivery, will be reduced to one to two weeks, rather than months, thanks to more readily available data.
- Data analytics services and user data will be supplied at a reduced price or for free to small and medium-sized businesses and startups with insufficient technological and human resources to assist them to develop innovative services.
- Benefits for both people and corporations in terms of industrial progress. According to the MSIT, the data service markets will grow to USD 38 billion (KRW 43 trillion) in volume by 2025, from current levels of USD 17 billion (KRW 19 trillion), thanks to the development of consumer-centric data platforms that make it easier to search and access data. The data industry's workforce is predicted to grow from 360,000 employees in 2020 to 470,000 by 2025.

Integrated data platforms will allow public and private institutions to actively access and analyse data, as well as bring relevant services to markets, resulting in the data industry's overall expansion. As a result, the groundwork for establishing a data-driven innovation ecosystem in Korea will be laid.

Data access and exchange are becoming increasingly important for digital transformation and data-driven innovation. Countries have been concentrating their efforts in recent years on "data governance," or how, where, and when data, particularly personal data, should be acquired, stored, aggregated, and analysed.

President Moon Jae-in introduced the Digital New Deal in June 2020, with the goal of fostering a forward-thinking, innovative economy. The Digital New Deal aimed to hasten the transition to a digital economy by heavily digitising national infrastructure and promoting the DNA (Data, Network, and Artificial Intelligence) ecosystem as well as non-face-to-face enterprises.

The government's new focus on data governance reflects both technological and social dynamics: the growing importance of global cloud computing services; the emergence of new, powerful big data and machine-learning algorithms; and increasing public concerns about data protection and cyber security. The country has time and again recognized the importance of data and data analytics. Data Analytics helps decision making, in particular through low cost and rapid experiments (often based on correlations and A|B testing), as well as the use of autonomic machines and systems (based on machine-learning algorithms) that can learn from previous situations and to improve decision making. This understanding has helped Korea advance and make policies that further the advent of data and innovation in the economy.

Despite the growing need for access to data and also the ensuing economic and social benefits, data access and sharing have not reached their full potential as a result of ever-growing barriers to data access. Several countries practice data localization. This includes requiring data, particularly personal data, to be stored and accessible inside their borders. This has certainly complicated cross-border data flows with the prospect of hindering the development of the digital economy.

Korea is identified as having one of the most advanced ICT infrastructures in the world, and it has grown to become a testing ground for leading-edge applications. The country has consistently ranked first or second amongst 176 nations on the International Telecommunication Union ICT Development Index since 2009 and also ranked second in 2017, the most recent survey.

Korea's proportion of e-commerce transactions has reached 30 per cent, and the proportion of online banking has reached 66 per cent. In addition to this, Korea's geographic and demographic

advantages and its government-driven policies have been major factors in its ICT development. In the 1970s, a national public administration initiative led to the establishment of a resident registration system and the computerization of administrative information. In the 1980s, policies for the spread and expansion of telecommunication networks were implemented in earnest. In the 1990s, ultra-high-speed information communication networks were developed. And in the 2000s, the change to an information society led to the development and dissemination of internet-based technologies, laying the foundation for e-government services and improving information security. All these policies have contributed to the growth and progress of the country. The power of data has led to Korea becoming one of the world's most innovative countries in the world.

Leveraging Big Data for Development and the Way Forward

Big data are referred to bulk data that cannot be collected, saved, and analyzed with traditional data analysis tools. It has an important role to play in development, and Korea, with its dual experience in development and technology, is harnessing these opportunities.

Korea is a pioneer in the use of Big Data for development. It has a plethora of applications, especially in development, where large quantities of data can be used to build models, gauge consumer behaviour and accordingly roll out data-backed policies. t is used in policymaking, service delivery in the public sector, growth and competitiveness of SMEs, developing data science skills, and laying foundations of the infrastructure for the future. They do this through public-private partnerships, national institutes like the Big Data Strategy Center, part of the National Information Society Agency (NIA), and academia like the Big Data Institute of the Seoul National University.

Several programs have been launched by the Seoul Metropolitan Government (SMG) harnessing this technology.

The successful "Owl" night bus, is one such service. Under this, anonymized call locations were paired to yield an optimized network of only 8-night bus routes that cover 49% of the demand. SMG is also working on exploring other uses of Big Data to maximize taxi use, improve pedestrian safety, and better target advertising on public billboards.

Additionally, SMG is analyzing 25 years of data on pipe leakages from 1989 to 2014 in order to find the correlation between the leakage points and weather conditions. A new system based on that data analytics has been implemented, whereby modulating the pressure, they have been able to reduce the leakage rate (from 79% in 1989 to 2.5% in 2014). As a result, saving millions of dollars.

In addition to this, the national government is also planning to use Big Data as part of their upcoming Census, with an estimated savings of USD 140M.

In its quest to acquire even more benefits from technologies such as Big Data, the Korean government proposed the Korean New Deal, aiming to spend 76 trillion won ($62 billion) over the next five years to prepare the economy for the future. Digital New Deal, one part of the Korean New Deal, is focused on laying the foundations for a digital economy that will spur economic growth and innovation.

Information and communications technologies (ICT) are changing the world economy. The new digital economy that is emerging is led by technologies such as 5G, big data, and artificial intelligence (AI). IHS Markit estimates that by 2035 the 5G global value chain will be worth $3.6 trillion and support 22.3 million jobs. AI and big data are expected to have similar economic impacts, based on their importance.

South Korea is aiming to establish a foundation for competitiveness in these prominent fields that are the key to future growth and development. Overall, the Moon administration has proposed spending 2.7 trillion won ($2.2 billion) on the Digital New Deal in 2020, with additional funds to come in future annual budgets.

The development of a 5G infrastructure is critical to utilizing the vast amounts of data and harnessing the processing speed that is needed to realize the full potential of big data and AI. Korea is one of the world leaders in this, with a vast majority of the population already having access to 5G services.

However, Korea faces some challenges in the area of big data. While the country is a global leader in the creation of new data, it is unable to effectively use the data it collects, ranking 50th in the world in the Coursera Global Skills Index for data science.

The Digital New Deal would address data usability by creating a "data dam" to collect data from public and private sources and then standardize the data for further analysis. It would also utilize 560 billion won ($459.2 million) to establish 15 new big data platforms.

The Seoul Metropolitan Government manages millions of information assets and collects and analyses vast amounts of data generated throughout the city, such as those from the Transport Operation and Information Service (TOPIS) and the Big Data Business Environment Analysis Service, in order to provide efficient services.

However, the city government had no comprehensive integration protocol or institutional data coordination framework in place to manage the huge amount of data. The city's information systems and corresponding data assets were operated and managed in isolation by individual departments and institutions.

The Seoul Metropolitan Government created the Digital Mayor's Office—an integrated smart city data platform that brings together all available data to produce comprehensive, real-time urban indicators for strategic and timely decision-making—to consolidate fragmented data management and streamline the process of data utilisation at the leadership level.

The lack of data integration and institutional coordination had resulted in severe administrative inefficiencies. Important information was not reaching the leadership at a fast pace, resulting in missed opportunities to analyze and utilize data that could have helped the city avoid problems.

Seoul's vision for smart city development aims to "change the lives of citizens". Its objective is underpinned by five main principles: (i) people first, (ii) service-centred, (iii) inclusive governance, (iv) sustainability, and (v) innovative growth.

In all of its smart city initiatives, the Seoul Metropolitan Government employs a five-pronged strategy that includes needs-based planning, data utilization, public-private partnerships, business engagement, and a platform approach. Six intersectional policy areas have been identified as core priorities of Seoul's smart city development: smart transportation, smart safety, smart environment, smart welfare, smart economy, and smart administration.

In 2017, Seoul launched the Digital Mayor's Office, a smart city data platform designed to aggregate and visualize comprehensive, multi-sector urban data to facilitate more accurate and streamlined decision-making. Since its introduction, additional data and functionalities such as public disclosure of information were gradually introduced from 2018 to 2019. The entire process from basic planning to comprehensive integration took approximately three years, starting from mid-2016 and until mid-2019.

The Digital Mayor's Office currently integrates about 32 million data items from over 300 different information systems and more than 2,800 real-time CCTV feeds. Data is aggregated and visualized on the platform including real-time, multi-sector indicators on transport, health, safety, environment, socioeconomic and demographic indices, spatial information, culture, and administration. It also tracks public opinion trends, civil complaints, and information on major projects.

The traffic situation dashboard provides real-time traffic information such as bus/subway service, and road and pedestrian accidents. The data flow and architecture of the Digital Mayor's Office

is based on the Open Data Plaza, a public information disclosure system designed to share administrative data with the public on an open platform.

In this context, the Open Data Plaza provides a blueprint for channelling and categorizing data from across multiple databases and systems onto a central database. The Digital Mayor's Office is built on this pre-existing structure to develop a systematic data curation and management framework, expanding the scope of data to be integrated and introducing real-time data streams.

The system provides several benefits:

- It enables cross-visualization and analysis of previously isolated datasets to deliver new strategic insights and more timely responses to evolving situations.
- It reduced the time and resources required for administrative and bureaucratic processes involved in information gathering, reporting, and decision-making.
- It laid the foundation to align and reconcile all data operations across the entire city government into a unified strategic direction—paving the way for more standardized development of future information and data initiatives, and a more robust evidence-based approach to policymaking.

These are the several ways Korea is utilizing upcoming technologies such as Big Data to optimise the impact of their policies and drive the development of the country. With the Digital New Deal, the future of the country looks bright as it continues to focus on infrastructure development and improving the system as a whole.

Conclusions and Inferences

Online Authentication

At this point, we can clearly state that Korea's various online initiatives and persistent experimentation over the last two decades have resulted in it achieving pioneer status in the development of an easy-to-use online authentication ecosystem that can provide secure access to e-government services, online banking, and healthcare services—all areas where Korea excels. Furthermore, improved authentication may make scamming, spam, misinformation, malevolent hacking, and insider cyber theft more complex and less lucrative.

Our observations of Korea's trial and error process over the last two decades reveal a simple lesson: even in a developed economy like Korea's, presidential leadership might be a prerequisite for growth. Without the president's participation, the Korean government officials involved in

these attempts would have taken considerably longer to admit that reforms were required. However, what ensued was an endeavour to provide a broader, more flexible range of online authentication systems, the outcomes of which have been far more widely embraced and used than previous government-led initiatives, facilitating e-commerce, e-government, and mobile applications in Korea.

One conclusion is that the Korean government understood the potential for defamation, fraud, and doxing via e-mail and social media platforms long before practically any other government in the world. It also acknowledged that improved online authentication could help to mitigate these major and developing issues.

A real-name system was established in July 2007 to prohibit anonymous posting on major websites. This prompted concerns from privacy and free speech groups, as well as a lawsuit alleging that the measure violated the Korean Constitution. Furthermore, because the ban could not be enforced on international websites such as YouTube, Korean domestic websites claimed that the regulation was unfair to them. The Constitutional Court eventually deemed the law illegal in August 2012. This tumultuous Korean discussion over real-name authentication teaches us the importance of designing online authentication systems that balance the need for improved cybersecurity and data access management with the desire of internet users and businesses to secure their personal information. Unfortunately, activists for privacy and civil liberties in Korea were not heavily involved in the development of online authentication specifications and policies.

As Korea and other countries perfect their approaches to authenticating, they will need to think about how systems and procedures might allow citizens to authenticate what they are without revealing personal information. This could mean that internet users can safeguard their privacy by adopting a pseudonym or exchanging personal information with a trusted third party: this could allow a user's qualities, such as age, income, and country, to be verified without disclosing their identity. Several cryptographic techniques, such as homomorphic encryption, are making privacy-enhancing techniques more feasible and secure.

Another takeaway from Korea's experience with online authentication methods is that the most effective ones will be those that make use of the private sector's infrastructure and business relationships, such as mobile phone firms and credit card companies. Because few citizens engage with their government on a weekly or monthly basis, developing a system just for a few government applications is unlikely to be highly successful. Users are more inclined to use and trust authentication techniques that their residents are actively using for online banking or e-commerce if governments allow them. The potential applications (and economies of scale) will be substantially larger if this private sector-based strategy is implemented in more than one country.

Another reason why Korea's latest strategy could position the country as a global champion of stronger authentication is because of this. Estonia and India have proved the benefits of effective internet authentication by investing both money and political capital in their countrywide authentication mechanisms. However, their state-led approaches are less likely to be adopted as national, much alone global, models by third countries. Governments that fail to recruit foreign partners will suffer from the "Galapagos syndrome," in which their method of online authentication is incompatible with those of other nations. If governments are unable to overcome this obstacle, citizens may be forced to rely on authentication systems provided by multinational corporations such as Apple, Facebook, and Google.

Data Resilience

The Korean government has created a management structure for developing and coordinating cybersecurity strategies as well as strengthening the resilience of state and corporate ICT systems in the country.

The numerous cyberattacks against South Korea over the previous two decades, many of which originated in North Korea, have prompted a number of limited legislative responses. However, instead of developing and implementing a coherent strategy to limit the number and severity of attacks, this reactive approach resulted in a patchwork of initiatives. As a result, in 2019, Korea developed a full-fledged National Cybersecurity Strategy as well as a strategy to implement it.

The National Security Council, which is part of the President's Office, will be vital to the plan's success. It must act as a command centre for policy coordination throughout the government and across the public and private sectors. However, this is not an easy task. It will necessitate a multistakeholder approach that takes into account not only the interests of the ministries and offices concerned but also the different and unique needs of Korean businesses and residents. Policies that offer a variety of adaptable, inexpensive, and simple solutions will far outperform the one-size-fits-all strategies that certain countries have tried. Korea has the potential to lead the way.

Several Korean companies and government agencies have stepped up efforts to safeguard their IT systems, defend against denial-of-service attacks, and implement data backup and recovery solutions. Despite a constant increase in the number of attacks, this has successfully lowered the amount of harm caused by cyber-attacks in recent years. Korean legislation requiring data backup solutions are one option that other countries might want to consider. Korean legislation, such as Korea's Cloud Service Assurance Program, is supporting this endeavour by encouraging wider usage of cloud storage, particularly in the public sector.

Privacy and Data Protection

The research also looks at Korean approaches to data protection and localization, particularly the legal framework that Korean policymakers, lawmakers, bureaucrats, and mediators have meticulously put together over the previous two decades. Protection and localization are two of the most difficult digital policy concerns that national governments throughout the world are attempting to address. And no country has yet devised a strategy that benefits its population and enterprises while simultaneously being interoperable and compatible with other countries' data policies.

This is a difficult bar to clear, but it is especially critical for Korea, which is heavily reliant on commerce and cross-border economic flows of commodities, capital, people, tech, and data. Despite some deterioration during the coronavirus pandemic, Korea's trade dependency index (total trade volume as a percentage of GDP) remained at an astounding 63.51 per cent in 2020, according to the Korean Statistical Information Service, which is run by Statistics Korea of the Ministry of Economics and Finance.

Korea faces a particularly challenging burden as a significant economic partner with China, the United States, the European Union, and Japan. Korean companies are subject to a number of evolving global data laws, including the various ways European countries are enforcing the GDPR, the California Consumer Privacy Act (CCPA), and the new Indian data protection law, and others. They also have to contend with China, the country's major trading partner, which has very strict data legislation.

Korea has the ability to serve as a model for all of its trading partners, shaping and harmonising policies for cross-border data flows. Korean firms can acquire the trust of both Koreans and foreign corporations if they can demonstrate that they have appropriate data protection methods. Foreign companies may therefore be eager to collaborate with Korean partners. The open movement of data across international borders will become ever more crucial as ai technology, machine learning, the Internet of Things, automation, and bioinformatics improve. Korea must actively build on its accomplishments by helping to shape the growing global policy on cross-border data flows and access in order to be well-positioned to take advantage of these innovation opportunities.

There are actual contradictions between Korean residents' need for privacy, which is represented in the country's strict data protection regulations, and Korean businesses' desire to use non-Korean online tools and services and collaborate with international firms. There is also a tension between Korean privacy laws, and, the desire of both the Foreign Ministry and the President's Office to be able to sign onto several regional and global treaties that impose tight restrictions on how national law can impose its data localization requirements. One result has

been concerns from the United States, which is Korea's second-largest export partner after China and its second-largest source of FDI after Japan, that the country is not honouring some of its agreement obligations to allow data from Korea to be exported, particularly sensitive data like map data.

The benefits of sharing and analysing both health and geolocation data have been emphasised by the coronavirus outbreak. Advanced economies have used geolocation data from phones for coronavirus-related contact tracing, from Taiwan and China to Korea and Israel. Data on who has and has not been inoculated or infected has also aided in determining the efficacy of various vaccines and prevention methods.

However, we must analyse how the execution of Korean privacy rules might prevent data from being exported to nations with less stringent data protection regulations than Korea. The demand for reciprocal data handling is another barrier to cross-border data exchanges. If other nations refuse to allow their people' data to be transferred to Korea, Korea may prohibit data transfers from Koreans to those countries in order to pressure them to relax their data localization laws.

The collision of these divergent policy objectives will demand some fresh thinking, as well as maybe new business structures and technological innovations. However, there has been a high-level drive in Korea to identify methods to harness the power of data and emerging technologies like machine learning and location-based services.

This was encapsulated in President Moon Jae In's introduction of the Digital New Deal in June 2020, which aims to find new applications and promote the spread of Korea's DNA—data, network, and artificial intelligence—ecosystem. Still, the Digital New Deal's ambitious aims of using digital data to improve health, safety, government services, and commerce can be realised only if data protection legislations are more consistent and effective, and data localization policies are more explicit.

The way forward

Korea's success is due in part to its readiness to change course after a period of trial and error. The country has also done well in terms of technology implementation.

Korea's broadband internet rollout over the previous thirty years is one example. Here, Seoul has made digital policy a presidential priority once more a nd the Blue House's participation made a significant difference. Other foreign leaders, such as US President Joe Biden, have also hastened broadband expansion in the previous year or two by making it a priority for their administrations.

Executive leadership at the highest levels of government was also critical to Korea's success because forward-thinking politicians can help propel or at the very least establish wide and consistent political support for a strategic aim. Korea did this, for example, by pursuing the ambitious goal of constructing a national fiber-optic network that would service all Korean residents.

Korea's broadband push has resulted in it achieving some of the greatest internet penetration rates in the world, as well as low costs per megabit of access until recently. The decision in 1999 to encourage competition among the two telecommunications companies that controlled the Korean network market at the time was crucial to this effort. As a result, there is a thriving market with four main competitors and a slew of smaller players. And, when combined with state support for government networks and subsidies for rural broadband, the subsequent competition and innovation resulted in one of the world's quickest and earliest deployments of fixed broadband networks. Korean firms are now among the world's top 5G wireless broadband providers.

When it comes to Korea's digital policies, there are still many obstacles to overcome. Since early 2016, the Korean telecommunications regulator has been responding to lobbying from the three largest network service providers, who claimed that they were carrying more internet traffic than the smaller networks with which they interconnected. The fast rise of video streaming services like Netflix has resulted in a surge in traffic, necessitating additional network infrastructure expenditure. As a result, a complicated (and frequently revised) internet interconnection fee structure has been levied, favouring the three largest Korean network service providers over smaller players.

The concept of government-mandated interconnection fees is unheard of in practically every other country where a competitive broadband market exists. We've witnessed a propensity for negotiated contracts between networks in those countries. Netflix, which has opposed the fees, was recently sued in a Korean court by SK Broadband, based in Seoul. Netflix was found accountable for outstanding fees totalling more than $85 million per year by the court. This may appear to be a minor quarrel between telecommunications companies, but the fact that the Korean government favours only three of them will result in less competition and investment. Most crucially, due of the dramatic increase in networking costs resulting from these additional fees, numerous innovative new internet services, such as specific content distribution networks and cloud computing services, are not being offered in Korea.

This is an example of how Korean experiences may go wrong. It's also a primed area for the kind of digital leadership shown by Korea's president in the past, which has been a key ingredient in the country's success. Such leadership is required on both a political and policy level to ensure

that the interests of Korean internet users and digital entrepreneurs take precedence over the interests of just three firms.

These are the trade-offs and decisions that democracies must confront. Korea's democracy, like that of the United States, has grappled with a number of common issues, not least how to limit the damage caused by disinformation. North Korea has utilised the internet to spread propaganda and disinformation to South Korea. However, misinformation and rumours spread by South Koreans have a significant impact, particularly on Korean politics. Korean internet firms, for example, have actively blacklisted websites that promote rumours and false information. However, proponents of free speech in Korea (and abroad) have fought against government efforts to stifle online debate.

Korea has the opportunity to experiment with fresh ideas. Deep fakes—deceptive images and videos created by machine learning algorithms—are of particular concern. Microsoft and Adobe, for example, are working on new ways to validate the authenticity and provenance of online content.

Encryption is another thorny digital problem that is primed for Korean leadership. For more than two decades, governments of major democracies have struggled to craft policies that would allow the use of strong encryption to protect ICT systems and the data they contain while also dealing with the threat posed by criminals and adversaries who use encryption to hide their activities. This is complicated by the conflicting interests of law enforcement and intelligence agencies, which seek easy and inexpensive access to data on one hand, and the agencies in charge of data security and cybersecurity, on another. In Korea, there has been a minimal public debate about encryption policy, although the importance of encryption as a tool for preserving privacy is well understood. In fact, Korea's Personal Information Protection Act encourages businesses to utilise encryption to safeguard sensitive information.

Korea and Geopolitics

The fragmentation of the world into a Sinosphere or an American sphere would not suit the interests of most countries, which is one reason why Korean leadership might be so significant.

For decades, two competing approaches to technology policy have shaped the field: models that empower individual users and innovators (particularly at start-ups) while respecting human rights, and models that give governments more control over what technologies develop, how they are implemented, and which companies benefit the most (usually large incumbents and national champions).

Today, the United States sees itself as a champion of the former to some extent. China, on the other hand, has practised and argued for features of the latter.

However, many countries, including long-established democracies, are experimenting with a mixed approach. Many democratic governments, from Europe to Asia, rely on industrial policies to support national champion enterprises. They are taking a strategic approach to technological innovation and the regulation of domestic and cross-border data access and transfers, and they occasionally disagree on the optimal course of action.

There hasn't been a purported American-led "Team Democracy" vs. a Chinese-led "Team Autocracy" in data governance, for example. Indeed, when former Japanese Prime Minister Abe Shinzo attempted to push through a cross-border data initiative at the 2019 Osaka G20—the so-called Osaka track, which Abe's government based on a concept of "data-free flow with trust" (DFFT)—India and Indonesia, two significant G20 democracies that Washington views as key like-minded collaborators in Asia, refused to sign on.

Ironically, for all their ideological and strategic differences, Beijing and Washington are approaching the region in similar ways. Both have framed the competition over global rules in increasingly stark terms. Each is suspicious of any regulatory ideas developed by the other. Each is encouraging third countries to accept their preferred norms, standards, and rules. And each has framed the technology challenges, including over data flows, in geopolitical, not just commercial, terms. Each has sometimes coerced others to forestall closer integration with its rival.

Korea could offer a third way—one that relies on practices and experiences developed and incubated in a successful democracy that has also carved out an important role for the state and sought a balance between public and private interests and state and market-based approaches.

The intensifying battle between Beijing and Washington is leading to trade disputes, restrictions on foreign investment, and, increasingly, wholesale bans on the use of foreign web services and apps. Yet as demonstrated, countries like Korea have pioneered their own unique approaches to technology governance and regulation, and it is important to highlight these alternative models—and to compare and contrast their distinctive features.

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