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KDI Korea Development Institute

Research on the Digital Transformation and Ecosystem of Korea applicable to LAC companies

Digital Transformation

TABLE OF **CONTENTS**

ACRONYM TABLE

ACRONYM	DEFINITION
5G	Fifth generation technology standard
AI	Artificial intelligence
AMI	Advanced metering infrastructure
AR	Augmented reality
B2B	Business to business
CAE	Computer-aided engineering
CAF	Development Bank of Latin America
CCEIs	Centers for Creative Economy and Innovation
CDMA	Code-division multiple access
CEO	Chief Executive Officer
CES	Consumer Electronics Show
CO2	Carbon dioxide
DNA	Data, network, and artificial intelligence
DPINP	Development and Public Investments National Plan
DT	Digital transformation
DX	Digital transformation
E-commerce	Electronic commerce
e-Government	Electronic government
EAS	Extension and Advisory Services
EC	European Commission
ECLAC	Economic Commission for Latin America and the Caribbean (CEPAL)
EIU	Economist Intelligence Unit
EMR	Electronic medical record
ESS	Electronic switching system
ETRI	Electronics and Telecommunications Research Institute
FAO	Food and Agriculture Organization of the United Nations
FTA	Free trade agreement
GDP	Gross domestic product
HPC	High-performance computing
IDB	Inter-American Development Bank
IADB	Inter-American Development Bank
ICT	Information and Communications Technology
IMD	International Institute for Management Development
IoT	Internet of things
IP	Intellectual property
IT	Information technology
ILO	International Labour Organization
ITU	International Telecommunication Union
KBSENP	The Knowledge-based Society and Economy National Policy
KCA	Korea Communications Agency
KDATA	Korea Data Agency

ACRONYM	DEFINITION
KDI	Korea Development Institute
KISA	Korea Internet & Security Agency
KISDI	Korea Information Society Development Institute
KOITA	Korea Industrial Technology Association
LAC	Latin America and the Caribbean
LoRa	Long range
Lte-a	Long-term evolution advanced
MCST	Korea Creative Content Agency
MCTIC	Ministry of Science and Technology of Brazil
MIC	Ministry of Information and Communication
MISITT	Ministry of Science, Technology and Telecommunications
MOC	Ministry of Communications
MOI	Ministry of Information
MSIT	Ministry of Science and Information and Communications Technology (ICT)
MSTIC	Ministry of Science, Technology, Innovation and Communications
NCA	The National Computerization Agency
NIA	National Information Society Agency
NIPA	National IT Industry Promotion Agency
NSTIP	The National Science, Technology and Innovation Plan
OECD	The Organization for Economic Co-operation and Development
P2P	Peer to peer
PC	Personal computer
PPP	Public-private partnership
R&D	Research & development
RPA	Robotic process automation
QR	Quick response code
SDF	Seoul Digital Foundation
SMEs	Small and medium enterprises
SOC	Social overhead capital
STEM	Science, technology, engineering and mathematics
TDX	Time division exchange
TRIPS	Trade-related aspects of intellectual property rights
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNPOG	United Nations Project Office on Governance
VR	Virtual reality
WEF	World Economic Forum
WHO	World Health Organization
WTO	World Trade Organization

FIGURES

TABLES

EXECUTIVE SUMMARY

The two buzzwords in this century are digital and transformation. Digital transformation (DT or DX) is the set of integrative strategic actions directed by companies, institutions, governments, social groups and individuals with practical strategies that leverage digital technology.

This report looks into what Korea went through before becoming one of the leaders of digital transformation today. When the Korean government began its national informatization initiative in the middle of the economic recession caused by the Asian Financial Crisis in the late 1990s, no one thought the bankrupt country would be a digital leader in the next decades. Now the country is one of the digital transformation leaders in the global economy. It ranked second out of 11 countries in the Asian Digital Transformation Index from the Economist Intelligence Unit (EIU), eighth out of 64 countries in the IMD Digital Competitiveness Index Ranking 2020, and the first out of 10 countries in the European Innovation Scoreboard 2021. As the cases of digitization and digital transformation have stacked up in the public and private sectors, the country is asked to share its experience and knowledge with global communities, including its partners in Latin America and the Caribbean.

To analyze the Korean digital transformation case, the development process of Korean digital transformation ecosystem has to be looked into from its roots. What should be noted in the case of digital transformation in Korea is the long-term digital transformation strategic actions led by the government. The government and related public institutes led the national informatization policy from 1996. The government funded informatization and digital transformation, which facilitated public-private partnerships and supported ICT human capital development. These strategic actions have built the digital transformation ecosystem, including infrastructure, industry and talent, which have laid the essential foundation for the current socio-economic technical and business change, now called digital transformation. When taking all this into account, it is difficult for anyone to find a quick, magical digital transformation strategy that can be effective in a short period.

Summary

However, the evolving ecosystem of digital economy has produced some noticeable transformation cases in various public and private sectors. In this report we selected 10 cases to demonstrate how companies, the public and individuals have created digital transformation. The main players in these cases are companies, institutions or individuals, who have created digital transformation across diverse fields such as agriculture, e-commerce, energy, finance, healthcare and education. The transformation stories included here are:

- **POSCO**, a manufacturing company founded in 1968 that transformed itself into a smart factory

- **LS Electric**, a company that exchanged existing brand value for a future business model to achieve strategic innovation and digital transformation

- **LG Group**, a business group in which corporate leadership can cause digital transformation

- **Ministry of Science and ICT and National Information Agency**, the leaders of the National Digital Transformation project to spread digitalization across sectors

- **Seoul Digital Foundation**, a public and private partnership organization leading the Smart Citizen Lab

- **Classting**, a Korean teacher who leads digital transformation in global classrooms,

- **Kakao Bank**, a new company opening up a new digital financial market having high regulation uncertainty

- **Market Kurly**, a newcomer armed with digital capability to compete with giants in the e-commerce market

- **N.THING**, an agricultural business without farmland

- **SKT**, a telecommunications company that digitizes market cultivation methods and seeks scientific farming using data.

SUMMARY

The digital transformation technologies that appear in these 10 case studies are also explained briefly in this report. The case studies highlight that digital transformation strategy should vary depending on the situation and context, but also provide general lessons from the transformation experiences as follows:

- Digital transformation is a major challenge, even for non-digital industries
- Leadership can trigger digital transformation in a top-down manner
- Individuals can be the leaders in digital transformation
- Digital transformation can be a useful competitive advantage for startups
- Digital technology can go beyond typical sectors and create new agricultural businesses

But once again, there is no quick scheme to imitate or replicate and adopt other existing digital transformation practices because governments, infrastructures, industries and talents are unique and different. Therefore, this report is specially dedicated to suggesting a strategic framework that would not vary depending on the situation in digital transformation practices, especially for Latin American countries.

The report proposes a framework for facilitating digital transformation that is composed of the newness of the following fundamental pillars: **good governance, strategic infrastructure, human capital, convergence, regulations, innovative technology and cooperation**. All fundamental pillars are needed to ensure the best strategic decisions and actions for digital transformation practices.

• **Good governance** for digital transformation is needed to establish specialized government promotion agencies and associations in ICT fields; to promote people's participation in governance, informatization and knowledge sharing; to establish a public-private committee for ICT implementations and digital transformation initiatives; to make specific budgets and obtain funds for ICT with distinct purposes; and to publicize continuous transparency and accountability of government activities.

• **Strategic infrastructure** for digital transformation is needed to invest in a framework that increases the coverage and quality of connectivity; to promote building IT industry infrastructure as a top priority; to design and implement high-speed network roadmaps based on IoT, cloud computing and blockchain; to support national digitization plans and e-Government transaction systems; and to create supporting a tech-based education infrastructure and environment.

• **Human capital** for digital transformation is needed to develop and promote the long-term vision of a hyper-connected society and develop future skills; to improve interaction between the industry and academic sector to ensure human talent meets labor demand; to focus on investing in inclusive IT skills training programs; to deliver advanced IT courses for entrepreneurs, workers, public officials and students; to strengthen online education systems for universities and provide job training; and to give preferential treatment to ICT, science and engineering sectors to prevent brain drain.

• **Convergence** for digital transformation is needed to make use of public-private partnerships as collaborative win-win assets; to establish and support ICT R&D institutes with proper assessments; to create public awareness of digital transformation by designing an ICT convergence diffusion strategy; to support demo days, hackathons, startup events to promote ICT convergence in all industrial sectors; and to host special showcase events for startups to share ideas on their innovative products and services.

• **Regulations** for digital transformation are needed to enact special laws that support plans and funds to promote informatization; to create a legal framework to protect personal data and prevent violation of privacy; to take deregulation measures on unnecessary acts to ease entry barriers of promising sectors; and to designate special zones such as free economic zones and deregulatory sandboxes for developing and operating businesses.

SUMMARY

• **Innovative technology** for digital transformation is needed to share the vision of new businesses development in alignment with DX technology roadmaps; to encourage technology cooperation from universities and research institutes to private enterprises; to recognize the importance of intellectual property and promote investment in technology development; to foster transition to a DX society and support development of smart city transformation; and to encourage entrepreneurship of startups and SMEs to move toward the fourth digital revolution technologies industries.

• **Cooperation** for digital transformation is needed to institutionalize a novel local, regional and international cooperation model that allows addressing various structural challenges in LAC through innovative partnership, cooperation and development; to exploit the current bilateral trade agreements; to promote long-term investment supported by the international development bank system; to reinforce international R&D collaboration; and to strengthen north-south agreements aimed at implementing DX in the region.

One of the efforts that can be attempted in the relatively short term to expand successful practice development is global cooperation with digital transformation leading countries. Innovative leaders in digital transformation should not limit their activities within the border or single hosting country. By building mutually beneficial global partnerships, the players can expedite digitization and transformation as well. In this context, Latin America and Korea have already integrated various types of channels. IDB, Central American Bank for Economic Integration (CABEI), and multilateral consultative channels including East Asia and Latin America Cooperation (FEALAC) and Korea-LAC Future Cooperation Forum are good examples.

There are also business and technology exchange and cooperative channels including Korea-LAC Business Summit, Korea-LAC Startup Pitch Day, Korea-Latin America Food & Agricultural Cooperation Initiative (KoLFACI) and Korea Program for International cooperation in Agricultural technology (KOPIA) centers. Moreover, the LAC-Korea Deep Tech Exchange Program by the Born2Global Center in Korea and IDB LAB has been active since 2020. The program matches LAC-Korea venture partnerships to develop digital transformation technologies such as an employee work management and education solutions, a logistics transportation platform solution for cargo drivers, a VR safety education and AR maintenance solution, personalized language learning courses with AI diagnosis, and a self-travel guide service for the visually impaired.

Still, empowering local innovation capacity for digital transformation needs the essential components of good governance, strategic infrastructure investment and human capital, in addition to global partnership. The Korean experience tells that all economic players, including those in non-digital sectors and small and medium firms, and every individual should prepare themselves for technological changes to find new opportunities in the dynamic global environment.

1 Introduction

1.1.

WHAT DOES DIGITAL TRANSFORMATION MEAN?

In the past 20 years, companies were designed, planned, oriented, and supported by technology trends. Their processes and goals were outlined based on the use of digital technologies with values such as innovation, transformation and disruption. Organizations have cultivated cultures allowing them to easily adapt to new market environments. However, technology shift speed is increasing exponentially, and new companies are challenged to rethink their strategies and decide which technology will fit best to create synergy in the core business.

Digital transformation means not only simply digitizing and recording passive information, but changing the way companies work and interacting with other companies. Furthermore, digital transformation enables participants to transform the inherent attributes and business models of companies. That's why we have to understand the background of this change.

New generations who have grown up in a digital environment

One of the reasons why businesses change is because their customers and employees change their behavior. Generations that have grown up in an environment where digital is taken for granted have emerged. According to Marc Prensky, in his book "The Death of Command and Control?", the people born between 1995 and 2015 are considered the first Digital Native Generation. Prensky, besides being globally famous for coining the terms "Digital Native" and "Digital Immigrant," is also known for outlining the inner attributes of the "MZ" generation.

The MZ generation is the first generation to have grown up with devices such as desktops, laptops, smartphones, tablets and smart watches, but even more important, with the worldwide omnipresence of the internet and social networks. This generation is navigating the internet naturally; their reading habits are mostly based in digital content, they use real-time streaming digital audio and video content and players, take digital photos and know how to retouch, edit and send, make multimedia presentations, communicate with a wide range of social networks, and expect almost real-time instant responses and create their own digital content independently. They are multitasking, stand out for their speed in decision-making, self-learning, high-computer-based-knowledge and they immediately seek valuable results. The MZ generation is the first transformative generation connected to the internet all the time.

Eventually, with the advent of new waves of technology together with people's new consumption trends, they will need to evaluate how it will be affected by the market incumbent technology or how they can leverage future growth based on business transformation supported by those rising technologies. We now have the MZ generation forming a culture of using "memes," which were used as classic sociological terms, then revived in the 2010s to describe new ways of communicating and forming an unprecedented type of play culture. Not just one single individual, but an entire network of people around the globe are communicating with each other, as if all cultural phenomena are self-replicated, sharing what we feel, experience and value.

Concept and significance of digital transformation

Digital transformation focuses more on business innovation, resulting in changes in humans and corporations. The direction of digital transformation points to the process of integrating digital technology into all aspects of business, requiring fundamental changes in technology, culture, operations and value delivery. To make the most of the rapid spread of new technologies to humans, all processes and models must be fundamentally transformed to transform the business itself, and corporate culture must be changed to support the acceleration of this transition (HP Enterprise, 2021). In particular, all Fourth Industrial Revolution technologies are having massive impacts on business models, in the production sectors, in workplaces, and even more broadly: in the way humanity works, innovates, lives, interacts and studies or is educated (Salazar, 2018). This is not limited to the profit-chasing enterprises, but also applies to society itself, as the value of digital transformation is realized among all stakeholders. We are definitely facing disruptive changes that we saw a decade ago with the birth of the smartphones, the great product of digital convergence that hit the world, and now it's time for more changes for people and the ecosystem itself, which is represented as digital transformation.

This report defines digital transformation as the set of integrative strategic actions directed by companies, institutions, governments, social groups and individuals with practical strategies that leverage digital technology. And the goal of digital transformation is improving quality and sustainability of businesses and the lives of digital transformation stakeholders such as innovative job creators, smart clients and intelligent customers by providing better conditions in their everyday lives and businesses with the adoption of innovative Fourth Industrial Revolution digital technologies. The technologies include artificial intelligence, big data, cloud computing, machine & deep learning, internet of things, augmented reality, virtual reality, fintech, blockchains, digital twin, 5G, metaverse, etc.

Digital transformation enables business innovation, triggering strategic responses with a better customer experience and highly innovation-oriented added-value production. As we already mentioned, allowing companies to become digital natives by facing transformation challenges is even more challenging for those traditional institutions who will require a big leap to reinvent their business and adapt the company and employee organizational culture to absorb the advantages of digital transformation.

Digital transformation, digital economy, digital agenda, digital diplomacy and digital dividend

We stand by the point that digital transformation is at the very core concepts proposed by various organizations, where we have already seen the evolution through digitization, digitalization, and finally, digital transformation, as the driver of the prosperous digital economy that the World Economic Forum has proposed (WEF, 2015). , It can solve the by-product problem of the digital divide, where we see regional and social differences and inequality from a global perspective. Even now, digital transformation acts as the center of transformative actions. We now see digital agendas on shaping a country's and region's digital future, where it encapsulates digital strategies of the government, including e-government plans and digital economy promotion strategies in the public sector. Digital diplomacy is carried out strategically by countries, as the world's regional connectivity has dramatically increased from access to internet-connected devices and networks. We are now living in the world of digital dividend as proposed by the World Bank (World Bank, 2016) where we see the broader benefits of adopting digital technology, highlighting resilience and inclusion, from strong evidence that "digital" is not only profitable, but also results in the sharing of wisdom, knowledge and economic prosperity. Digital transformation lies at the center of the important milestones we have mentioned above.

Yet, the definition and the real meaning of digital transformation must take into account the evolution of understanding and values due to the breakneck pace of developing technology. Globally, there are still remaining businesses that did not migrate to the latest cutting-edge digital transformation technology even when new updates or technologies are taking over their businesses and markets. Digital transformation is happening and will prevail with new generations.

in their everyday lives and businesses with the adoption of innovative Fourth Industrial Revolution digital technologies. The technologies include artificial intelligence, big data, cloud computing, machine & deep learning, internet of things, augmented reality, virtual reality, fintech, blockchains, digital twin, 5G, metaverse, etc.

1.2.

WHY LATIN AMERICA AND THE CARIBBEAN?

The Latin America and Caribbean (LAC) region is home to 8.4% of the world's total population. It is composed of 42 countries that represent 15% of the world's land area. Most of its countries are part of the middle-income economies; however, some of them already have high income levels, such as Chile, Uruguay and Panama, while Haiti still maintains low-income levels (World Bank, 2019). LAC is a dynamic region where significant advances are juxtaposed with socio-economic and human and economic development challenges. Also, it is characterized by a precarious labor market, high inequality levels and economic vulnerability. According to the United Nations (2021) it has been the most negatively impacted developing region in the world because of the pandemic: 28% of deaths from COVID-19 were in the LAC region. This region also contracted economically by 7.7% (ECLAC, 2021) and it is estimated that it lost around 26 million jobs (ILO, 2021). The situation is aggravating socioeconomic structural issues that LAC has been facing. However, the pandemic has demonstrated that countries with stronger digital capabilities tend to be better prepared for short- and long-term challenges.

Digital transformation could significantly turn LAC's current social and economic crisis into a development opportunity. Across the globe, countries with stronger digital infrastructures are able to implement online health services, online education, teleworking alternatives and digital payments, which are important needs during a pandemic. Digital transformation involves innovative and disruptive changes in business models, value chains and production systems, and establishes new key factors that promote competitiveness (OECD, 2020). In this light, digital transformation could provide new opportunities for the region to address its structural issues, and at the same time, it would help to strengthen its competitiveness, resilience and social inclusiveness.

How is LAC doing in terms of digital transformation? Digital transformation is still in its infancy and introduction. The majority of big LAC enterprises are familiar with digital transformation, and it is a topic of discussion; however, LAC small and medium enterprises (SMEs) have less digital transformation awareness, adoption and capabilities (IADB, 2019). The pandemic has demonstrated that it is already time for governments, businesses and citizens to take bigger steps in digital transformation adoption to strengthen the resilience of their societies and boost their productivity. In LAC, in terms of internet access, 2 out of 3 people use the internet (World Bank, 2019) while 8 out of 10 companies[1] are connected online. In e-Government, there is an ostensible gap; countries such as Uruguay, Argentina and Brazil ranked 26th, 32nd, and 54th, respectively, among 193 countries, on the upper tier of the UN E-Government Development Index 2020 list. Others were lower on the list because of inadequate ICT infrastructure and lack of highly skilled talent (OECD, 2020).

To achieve digital transformation, LAC requires strategic innovation partnerships that support its path to overcome its structural business ecosystem issues. International partnerships could be invaluable support for LAC, especially the ones that come with more innovative and creative cooperation models that help to address several of the region's issues at once. A strategic partnership with innovative countries and companies in digital transformation would be crucial for LAC to take advantage of the best of the opportunities that digital transformation offers.

[1] Argentina, Brazil, Chile, Colombia, Ecuador, México, Peru and Uruguay (CAF, 2020).

1.3.

WHY KOREA?

When the pandemic hit the world, the international community paid close attention to one country, Korea. The pandemic heralded the application of digital technology in the health sector. Before, health and technology were thought to be entirely different areas. This gave a lesson to the world: digital technology can solve real-world problems. But why should we pay attention to Korea, a relatively small country in size in a region that is far from LAC, as a model for digital transformation? Why should we take a deep dive into the digital ecosystem that Korea has built over decades?

The Republic of Korea is a relatively small country located in the center of East Asia with a population of about 50 million and an area of about 100,000 square kilometers, but it took less than 70 years to become the world's sixth-largest exporter after being the world's poorest shortly after the 1950 Korean War. Korea is now considered one of the most innovative countries in the world (2021 European Innovation Scoreboard, 2021).

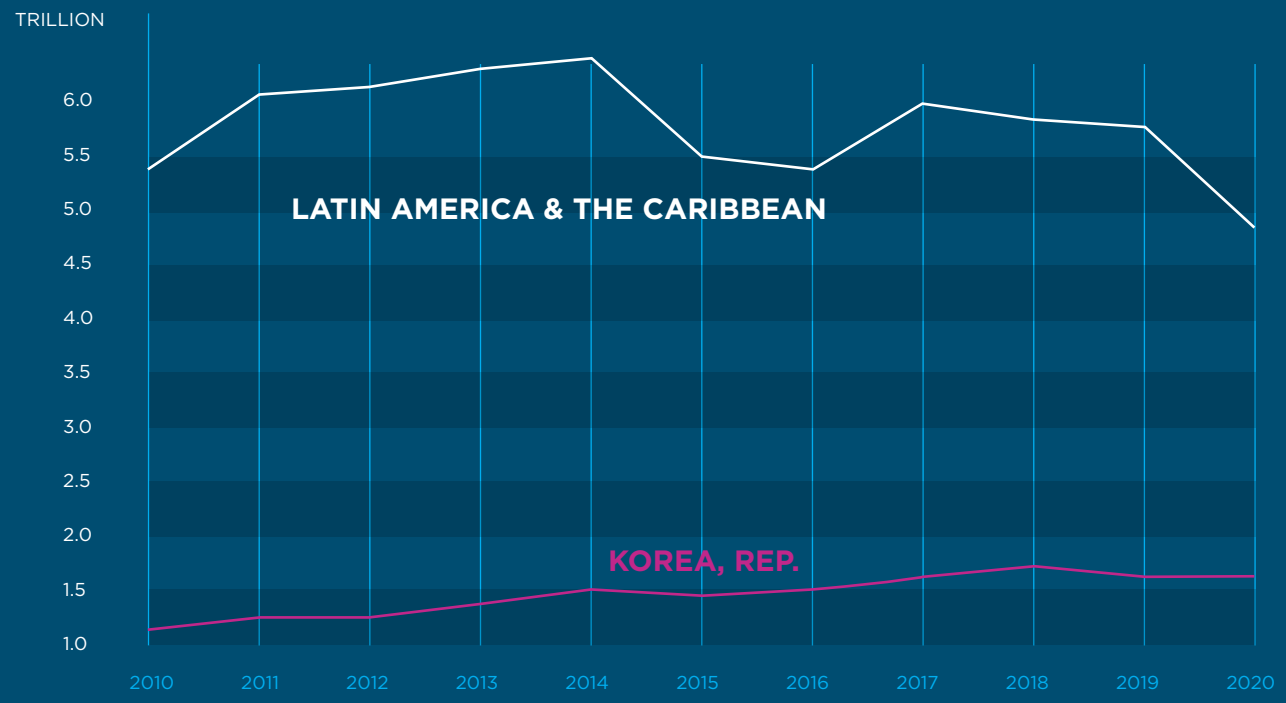
This process includes the promotion of manufacturing-based industrial policies represented by the miracle of the Han River and the industrialization of strong export-led policies, and democratization that succeeded from the active protests by citizen's power to claim political freedom in the 1980s. Since then, Korea has gradually achieved digitalization through balanced digital government policies, and trust in digital policies has been deeply rooted not only in the public sector but also in the private sector and ecosystem, leading to the present. The development process of modern Korea started with little hope, in that it was based on a state of division that continued after the Korean War. In other words, Korea's development process and results are a remarkable example of overcoming constraints. In particular, digital policies based on democratization and industrialization bring lessons to other countries currently agonizing over how to approach digital transformation.

TABLE 1. DEVELOPMENT INDICATORS OF LAC AND KOREA

Indicator	Latin America and the Caribbean	The Republic of Korea
Gross Domestic Product (World Bank, 2020)	$ 4,84 trillion (5.71% of global GDP)	$ 1,63 trillion (1.92% of global GDP, 15th)
The number of Patents (WIPO, 2019)	55,700 (CAGR over 10 years: 0.06%)	218,975 (CAGR over 10 years: 2.85%)
Average Annual Wage* (OECD, 2020)	$ 26,729(Chile) $ 16,230(Mexico)	$ 41,960
Population with tertiary education 25–34 year-olds* (OECD, 2019)	33.73%(Chile) 23.59%(Mexico)	69.80%

* Records of Chile and Mexico instead of regional averages. Among the LAC countries, Chile and Mexico are OECD members along with Korea

FIGURE 1. 2010 - 2020 GDP TREND (WORLD BANK, 2020)

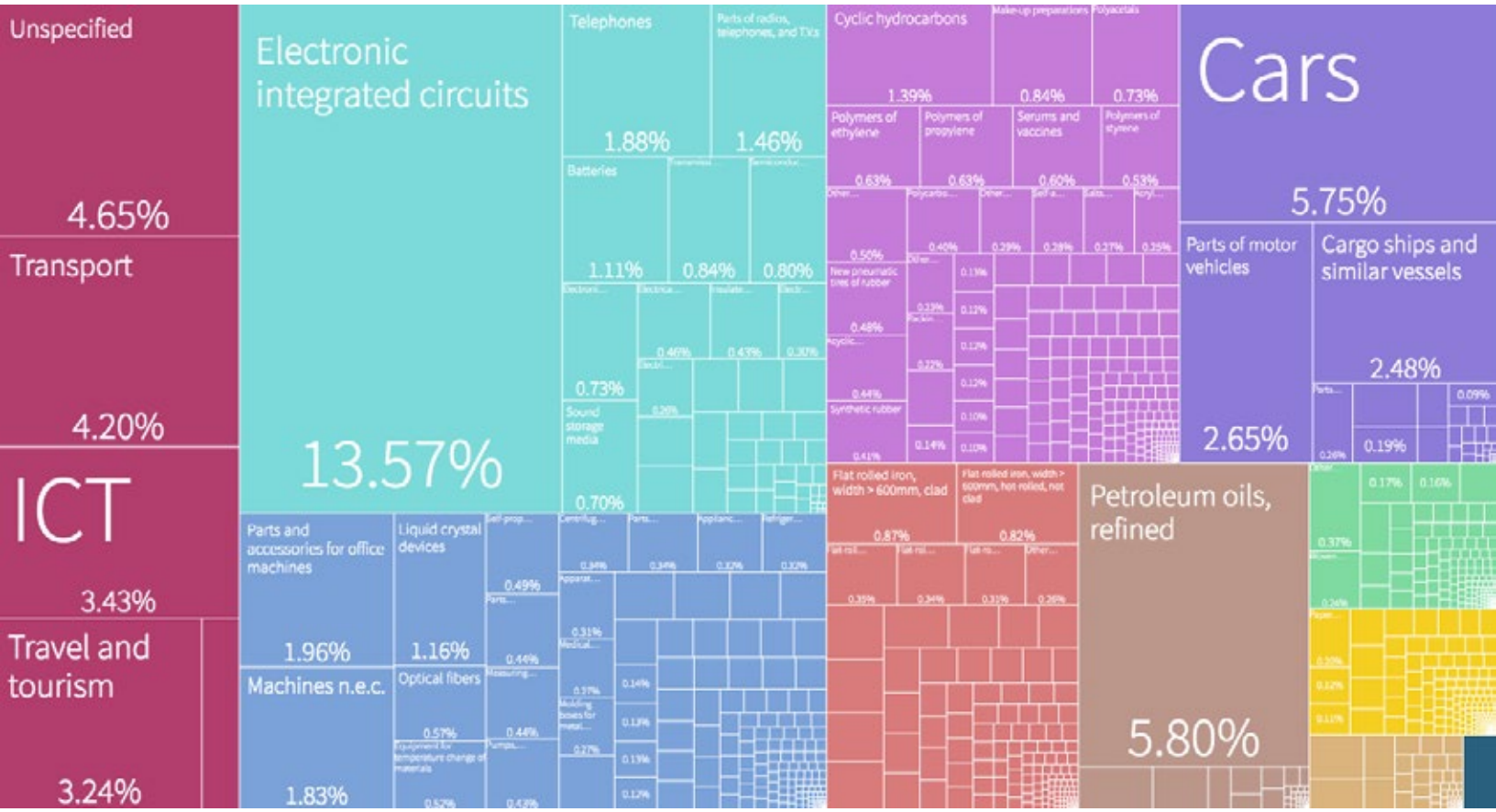


According to the above table, compared to the LAC region, the country of Korea has achieved higher growth in its economy, albeit with its initial adversities. During the 1980s when Korea's economy boomed, the annual GDP growth rate almost reached 10%, accelerated by favorable conditions (low oil price, low interest rate and the weak Korean won).

The driving force behind such dramatic change is Korea's export-led industrialization strategy and businesses aligning with this strategy. As a result, successful foreign export cases, including complex manufacturing goods such as ships, cars and electronics, were benchmarked, and the quality of the production has improved over time. Of course, this did not begin out of anything. The conglomerates in Korea, called Chaebols, triggered their own fierce competition in the country's market - including the construction business, manufacturing, retail and wholesale business, the food industry, the electronics industry, in every sector where the winners had a chance to face the world. Thus, with courage, belief and will, Korea has started to compete globally. And the export competition resulted in overall prosperity of not only the manufacturing industry but also others in the service industry, contributing to the growth of small and medium enterprises. Also, the long-term planning and execution of the strategy have resulted in the increased global competitiveness of products made in Korea, income, and investment in education.

Now, Korea maintains export-oriented economic growth, and exports account for 32.94% of GDP. The main export items are semiconductors, automobiles, petroleum products, automobile parts, flat panel displays and sensors, synthetic resins, marine structures and components, steel plates, wireless communication devices and plastics, accounting for 56.1% of total exports. In addition, large companies with assets of over 5 trillion won accounted for 84% of GDP, forming an economic structure centered on large companies. It is noteworthy that among the total 6,526,544 companies, the proportion of manufacturing, telecommunications, science and technology service industries classified as technology enterprises reached 12.67% (Harvard Atlas, 2019). The current stage of Korea's economy lies in technology-driven industries, which establishes the country's position as being one of the most innovative tech-driven players in the world.

FIGURE 2. WHAT DID SOUTH KOREA EXPORT IN 2019?
(HARVARD UNIVERSITY GROWTH LAB)



Moreover, the Korean economy, with a well-connected ICT network and high digital literacy, helped the society to respond effectively to the unexpected pandemic. During the pandemic, when a citizen tries to go to a shop, store or dining place, they generate their QR code using a smartphone application and show it on the screen, which authenticates onto a platform developed by private-public cooperation, and keeps track of the places that person visits. If an infection has been reported at a site, the government calmly orders for quarantine for those potentially exposed using the information from the registry. Personal information is anonymized to ensure privacy. This simple but powerful mechanism prevents more infections, which means fewer deaths. This has become the new normal in Korea.

The Korean contact-tracing system has helped keep track of people, show networks of how people contact each other, and tell those who might potentially infect others that they need to watch out before they meet up with their families, friends and colleagues. And it has a deep relationship with the success of digital transformation, also referred to as “digital adoption.” This is one example, but it prompts more questions: How was this possible and why? What will happen in the post-COVID era? These are the questions we have to ask. Now is the time for Korea to share the steps of digital transformation experiences with other countries’ governments.

Digital transformation is opening up new possibilities of shared growth among countries. When the steam engine was invented, changes triggered by this invention transformed the economy. What we call the middle-class today was born from the Industrial Revolution. General public education was introduced, and apart from the expectation that jobs would be lost, there happened to be more job opportunities, proportional to the economic expansion. In retrospect, at that point in history, humankind saw what was possible in terms of development.

That is why we refer to such phenomena as “revolution.” It is the same today. We are on the brink of the Fourth Industrial Revolution, and we are having the same discussions on education and working opportunities. At the core of it is digital transformation. We already know that the recent growth of the knowledge economy is fierce, and not only the multinational platform unicorns, but also the rising startups show high growth. Today, we are witnessing the explosion of growth as more and more stakeholders relate to the digital economy. So, on the whole, it is beneficial for others to join in the inevitable trend of the times. No matter where countries may be on the spectrum of the digital revolution, they all have room for improvement, and more participation maximizes their benefits.

2. DIGITAL TRANSFORMATION BASE IN LAC

2.1.

POLICIES IN LAC

It is important to highlight that digital transformation per se does not entail a unique formula for every country and does not have immediate results. It is a complex process that requires the support of public policies accurately coordinated and integrated both between and within each country of Latin America. For instance, technologies can contribute to boosting efficiency or productivity and increasing social inclusion, but a suitable and well-articulated policy will generate synergy to pursue and accomplish the proposed objectives with other partners.

Latin American leaders have combined efforts, and supported by the Organization for Economic Co-operation and Development (OECD), have reached consensus and developed policy recommendations to take advantage of technology to tackle the challenges in the LAC region. Public digital transformation policies should benefit the society as a whole. This approach also argues that the adoption of digital technologies must focus on people's needs and increase the quality of life of families and improve the wellness of Latin American societies while promoting sustainable development (OECD, 2020). Overall, the policy recommendations are focused on quality-of-life enhancement for all citizens. They demand commitment to avoiding discrepancies between sectors and boosting public services, improving health and education, supporting agriculture, and creating employment to strengthen the economy. Digital transformation is the assertive solution to make participation easier and modernize infrastructure, strengthen finance banking and finance practices, bring about opportunities for flexible business models, and embrace sustainable energy resources.

In addition, both public and private digital transformation policies need to account for local market awareness. The LAC region is characterized by numerous micro and small businesses with debatable productivity. These businesses are often unaware of their potential customers or are disconnected from their markets; the digital transformation can contribute to boosting productivity and increasing competitiveness for these companies (OECD, 2020). This is why policies must also support the adoption of various technological tools to cope with customized needs and create suitable digital ecosystems (for clients, customers, providers, developers), adequate infrastructures, and appropriate digital knowledge to enable interaction between ecosystems.

Digital technologies also create opportunities and challenges for the labor market. Across the region, some jobs may be automated whereas others will experience significant changes in their traditional execution (OECD, 2020). Consequently, policies must address the needs of the existing market. This implies fostering technology implementation and also facilitating new job opportunities to avoid unemployment. This is a constant productivity-enhancing cycle that needs to be supported with thorough policies to ensure a smooth transition from traditional to new-generation jobs, leaving outdated jobs behind.

Digital transformation fits all entities within society; hence, every type of organization and firm is impacted. Thus, digital transformation can also alter public institutions. Since LAC public institutions are considered bureaucratic and inefficient, digital technologies can contribute to making them more efficient, innovative and inclusive (OECD, 2020). In this way, policies are compulsory to enhance public services through internet tools (e-learning, videoconferencing, e-health) or to make public services more transparent (open data) and inclusive (decision-making processes).

Notable in the Latin American region, several governments have developed their own approach to engage with national digital transformation strategies.

FIGURE 3.
LAC GOVERNMENT'S STRATEGY FOR DIGITAL TRANSFORMATION

Argentina

For instance, the Argentinian government enacted the "Digital Agenda Strategy." It aims to articulate and coordinate government initiatives regarding the adoption of digital technologies. The strategy focuses on economic development, the digital inclusion of all Argentinians, and the building of an efficient and citizen-centered government. The plan also contains the guidelines of a digital strategy at the country level, as a frame of reference, and the context in which to move toward the future. The government maintains that the strategy will generate tangible benefits to guide and support the private sector to align expectations and reduce uncertainty, boosting investment and guiding the training of human resources (Boletin Oficial, 2018).

The foundation for Argentinian Digital Agenda 2030 is organized into five areas: 1) regulatory framework, which aims to smooth technology adoption with effective regulations; 2) infrastructure, which is the platform for the entire transformation, including education, health, agriculture, and how to protect data in all the interactions; 3) digital education and inclusiveness, which seeks to strength internet usability and foster innovative research tools to enable competitiveness in the market; 4) digital economy, which focuses on the development of software, agriculture and biotechnology, as well as fostering the digital transformation for SMEs and creating alternative business models; and 5) digital government, which fosters online services and aims to secure data in every transaction (Argentina SIP, 2018).

Brazil

In Brazil, the fast pace of digital transformation and its impact on the economy and society are significant concerns for the Brazilian government. Brazil's digital strategy objectives include four main sectors: agriculture, health, industry and smart cities (OECD, 2020). This engagement with technology transformation contributed to creating the Brazilian Digital Transformation Strategy (e-digital), which is coordinated by the Ministry of Science, Technology, Innovation and Communications (MSTIC). The strategy also seeks the commitment of the private sector, academia and research arena, and civil society through stages of the elaboration process. Moreover, the strategy's policy clarifies the government's role as an essential enabler of digital transformation. The e-digital strategy is composed of four dimensions: 1) diagnosis of the current challenges; 2) vision of the desirable future; 3) a set of strategic actions aligned to that vision; and 4) a set of indicators and metrics to monitor the progress in pursuing these goals (MCTIC, 2018).

Chile

The Chilean government is promoting the digital agenda named "Imagina Chile 2013-2020" as a strategy to leverage digital inclusion as well as the development of services and applications within the country, particularly in education, health and e-commerce. By incorporating technological advances, the government holds the certainty that the application of technology is an increasingly relevant tool for the development of the country and to improve the quality of life of its citizens. Under this vision, digital strategies are considered a key element of economic development strategies, with a consensus that countries can use ICTs to transform their economies, where the action of the private sector is complemented by the facilitating role of the state (SUBTEL, 2013).

Similar to Argentina, the Chilean agenda is composed of five areas: 1) Strategic connectivity and digital inclusion, which aims to facilitate access to the networks and services of the knowledge society; 2) strategic environment for digital development, which pursues the creation of required conditions to encourage citizens' and companies' development in the digital era; 3) strategic education and training, which seeks to deliver skills to engage in the knowledge society through ICT, from school to working life; 4) strategic innovation and entrepreneurship, which creates a suitable ecosystem to ease ICT development and entrepreneurship by encouraging combined action of the productive sectors in technological matters and provides tools to promote innovative activity; and 5) strategic services and applications, which improve productivity and quality of life fostered by digital services.

Colombia

The strategy proposed by the Colombian government is to develop an ICT plan with the slogan "The Digital Future is for Everyone." This strategy will define a policy for the Colombian digital ecosystem, which aims to integrate all elements and technology: people, inputs, infrastructure, telecommunications services, IoT, AI, FinTech. All of them must be orchestrated by the government policy, supported with regulatory and social frameworks. This policy contributes to the ruling institution and allows for a sound and functional ecosystem (MINTIC 2020, (a)). The Colombian government grants ICTs as a means to generate social wellness and economic development. Ex-ante social and economic diagnosis pinpoints that there are significant regional, socioeconomic and age differences regarding the penetration and use of communications services. Therefore, the 2018-2022 ICT policy focuses on the accelerated closing of these gaps, and fosters ICT as a vital enabling instrument for entrepreneurship, legality and equity. The policy is composed of four areas: ICT environment for digital development, empowered citizens and households of the digital environment, digital social inclusion, and sectorial and territorial digital transformation. The government has the certainty that compliance with this policy will lead to greater dynamics in the private sector and an increase in the efficiency and targeting of public sector investment (MINTIC, 2018).

Costa Rica

Costa Rica's digital transformation strategy, named Digital Transformation Strategy on the way to the Costa Rica of the Bicentennial 4.0 2018-2022, and managed by the government of Costa Rica, was enacted by the Ministry of Science, Technology and Telecommunications, and supported by national government authorities. The transformation focuses on strategic areas such as education, health, social development, security, economy, e-trade, innovation, transportation, digital government, environment, and cities and territories. Furthermore, the strategy has the mission to promote digital transformation in Costa Rica; therefore, it is aligned with each of the public policy and national planning instruments such as: the Knowledge-based Society and Economy National Policy (KBSENP), the National Science, Technology and Innovation Plan (NSTIP), Development and Public Investments National Plan (DPINP 2019-2022) and other entities identified by the Ministry (MICIT, 2018).

El Salvador

El Salvador, similar to the rest of the world, has experienced radical internet transformation. The government created a policy in 1996 to boost the telecommunications sector and enable a competitive market with the development of the internet service to date. Without a doubt, the assertive vision at that time contributed to experiencing the benefits of technology. Currently, due to the policy's obsolescence, a transformation is required, which encompasses a widespread entity where all players are intertwined: private, public and individuals, etc. In this sense, the government set up the strategy for the coming years regarding digital transformation.

Called the 2020-2030 Country Digital Agenda, the first stage is to embrace the country's digital transformation. The strategy entails four distinct parts: digital identity, digital governance, modernization of the state, and innovation, education and competitiveness. Moreover, the strategy seeks to promote innovation beyond science and technology. Starting with education and training policies is a solid beginning. El Salvador is convinced that government must be the first to take the initiative to promote and enable technological and regulatory conditions so that, through effective public policies, the productive sectors can get the most out of it (SI, 2020).

Ecuador

The Ecuadorian government has developed the e-Government National Plan 2018-2021. This plan proposes an inclusive model focused on citizens, effective and efficient, and aligned with national government public policy. It seeks greater participation and interaction between citizens and the state and is focused on health, economy, environment, social welfare, education, production, tourism and security. Moreover, this plan shows the current situation of the country in matters of e-Government, as well as the actions that will be executed in three programs: Open Government, Closed Government, and Efficient and Effective Government (MINTEL, 2018).

Overall, these policies have not only contributed to LAC development, but have also fostered international collaboration. For instance, the EU is committed to digital collaboration with the Latin America region. Pursuing this partnership will reap the benefits of new technologies while promoting innovation and digitalization in both parties (Commission, 2021).

In brief, digital transformation is inevitable and has knocked on Latin America's doors; fortunately, governments are exceedingly aware and have developed policies to fit their own ecosystems. Time will tell whether policies are on an aggressive enough path; however, analysis demonstrates subtle enhancement in key indicators such as productivity. The next section presents numbers regarding industry status.

2.2.

INDUSTRIES IN LAC

Current shape of the LAC industry

The Latin America and Caribbean (LAC) economy accounts for about 6.5% of the world's economy. About 60% is concentrated in the service sector, and the industrial sector accounts for about 24%. In terms of exports, LAC's major exporters are Argentina, Brazil, Colombia, Ecuador, Mexico and Peru. Of the total exports, about 71% come from manufacturing, about 18% from agriculture, and about 11% from mining (ECLAC, 2020, (b)).

The region is highly dependent on agriculture, which provides 14% of jobs (World Bank, 2019) and is an important source that supports food security worldwide (Morris, Ashwini, & Perego, 2020). Interestingly, one of the characteristics of the agricultural sector is the constant interaction that producers have with their land and with consumers (Sandoval, Hernández, Ríos, & Martínez, 2019). The social restrictions resulting from the pandemic have limited these interactions, highlighting the need for mechanisms that allow constant monitoring of the farmland, or make it possible to enable fluid communication with agriculture-related players and finally, make it possible to publicize the products available to customers. These needs become fertile ground for carrying out the initiatives proposed by the digital transformation for this sector. The agri-food system needs technology-based solutions to support the decision-making process, enhance risk management, create interactive platforms for crop control and monitoring, improve the distribution chain and, above all, reduce crop losses (CEPAL, 2021, (b)).

The e-commerce industry is gaining importance more than before because of lockdowns and gathering restrictions. This scenario has placed e-commerce industries in a leading position in which their actions allow them to perform transactions that involve the flow of money (EY, 2020). In response, these sectors have adopted digital transformation strategies that have kept the region's economy active. The global retail and wholesale industry are making significant changes in an attempt to reach its customers more effectively (UNCTAD, 2020). Despite the need and popularity of this commerce sector, the industry in the LAC region still has a lot of potentials to be developed. Compared with the rest of the world, the LAC region is experiencing a delay in its readiness level for adopting e-commerce in retail and wholesale activities. In 2017 the electronic services provided by the region represented just 2% of the total world (CEPAL, 2021, (a)).

The energy industry is one of the most important foundations of sustainable economy and digital transformation. Undoubtedly, the increase in the number of electrical and electronic devices used in the healthcare, food, banking and e-commerce industries is putting the capacity of the region's electrical systems to the test (OLADE, 2020). In response to this demand, energy suppliers are also considering digital transformation initiatives which, based on the region's energy resource characteristics, generate efficiency in the industry. Another important value that coexists in this era of digital transformation is eco-friendly energy to prevent the apocalypse of global climate change. Latin America and the Caribbean have great potential to exploit renewable energies. Water, wind and photovoltaic resources have a large presence in the region, providing a suitable scenario for supporting millennium development goals. In the region, 75% of energy is produced by renewable sources, of which 80% is generated by hydropower (REN21, 2017); however, the presence of new technologies is not widely visible (CEPAL, 2019). On the other hand, according to the Latin America and the Caribbean energy magazine ENERLAC, it is expected that through 2040, the consumption of energy will increase at an annual average rate of 1.12%, with transport and electric appliances being two of the main consumers (González, Lee, & Schuschny, 2018).

The financial industry is also one of the foundations on which emerging companies, such as Technolatinas, can raise appropriate global funds and grow. The financial industry, which is the foundation of LAC's globalization process, is also one of the areas of great interest in digital transformation. 86% of regional banking entities have stated that they have accelerated their strategic digital transformation processes to take advantage of new technologies and thus improve the services offered in an integrated and transparent environment (Diez et al., 2020).

The healthcare industry is bearing an extraordinary burden by continuing to carry out traditional operations, causing countries such as Colombia, Ecuador and Peru to collapse their healthcare systems (EFE, 2020). This phenomenon is motivating the adoption of digital transformation strategies that allow dynamization of processes and a non-physical approach to patients.

With the understanding of those sectors in the LAC economy, the following section reviews the potential of digital transformation in each sector.

Agriculture

The agricultural industry, which accounts for 18% of exports in the LAC region, has the potential to transform current systems into more productive, profitable, transparent and agile processes, allowing access to new markets (IDB, 2021). According to the latest data on agriculture sector indicators issued by the World Bank in LAC, this sector represented 5.6% of GDP in 2020 (World Bank, 2021). LAC stands out internationally for its vast natural resources, given that its forest biomass is equivalent to half of its land area and almost a quarter of the world's forests. Approximately 30% of the world's freshwater and around 40% of renewable aquatic natural resources are also found in LAC. It accounts for 12% of the world's agricultural production and 16% of the world's agricultural exports., which could make LAC the world's leading food supplier in the near future. (IDB, 2018).

In 2019, agricultural exports from LAC totaled US $234.7 million. And four countries accumulated 75.5% of the region's total exports: Brazil (34.5%), Mexico (16.7%), Argentina (16.7%) and Chile (7.7%). Of the total, 22.7% went to the United States, 18.2% to China and 12.1% to the same LAC region (IICA, 2021). The products produced by LAC that have been most in-demand in international markets are: soybeans, with a growth of approximately 60%; sugar, with 27%; and coffee, with 11.9% . An important factor in the change in prices has been the global economic recovery, driven by massive fiscal and monetary stimuli in many countries (IDB, 2021).

The digital transformation in agriculture is possible through the use of tools like the Digital Agricultural Extension and Advisory Services (EAS) proposed by the Food and Agriculture Organization of the United Nations (FAO). Public and private agricultural companies can participate in an inclusive environment in which it is feasible to access advisory services, and above all creates synergy in which participants can exchange experiences, practices or recommendations, contributing to the building of skills and resilience.

EAS systems are composed of platforms that integrate terrestrial or satellite communication technologies, artificial intelligence, and geo-referencing systems. The use of these tools is usually dependent upon the level of education or relationship with technology, with private companies mostly using leading-edge technologies and public companies using consulting and communications services (FAO, 2020). For LAC agriculture to move to the next level, new key elements are required such as an adequate electricity supply and at least basic literacy skills related to the use of technological tools (FAO, 2020). There is also a need for the use of online management tools and services, mainly those related to digital banking, payment of taxes, access to subsidies, or municipal procedures. In this context, digital transformation benefits the agricultural community by breaking down those constraints that are naturally generated by the fact that agricultural areas are typically located far away from urban centers (FAO, 2020).

E-commerce

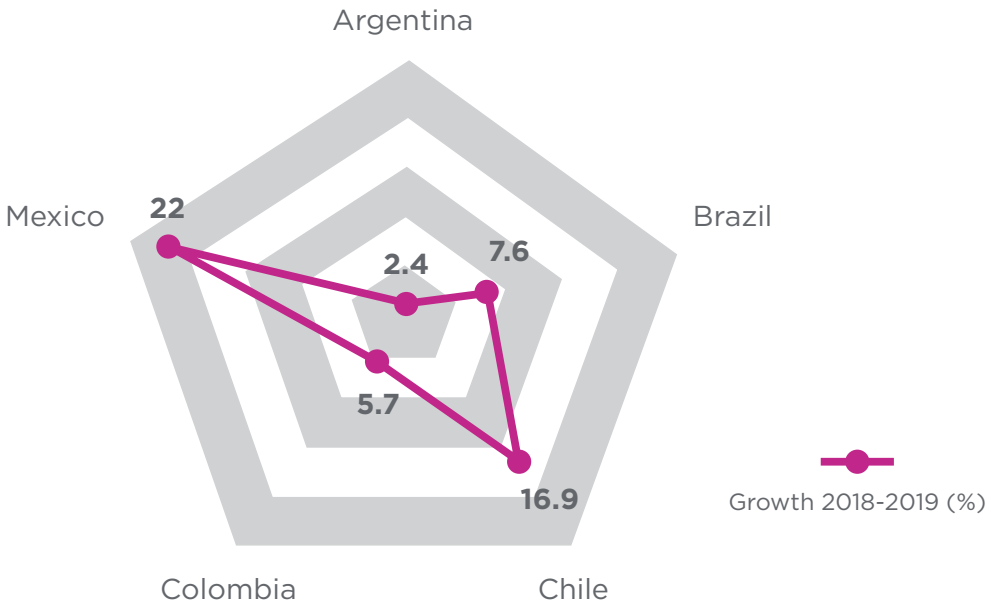
According to data from Statista Digital Market Outlook, in 2019, Brazil and Mexico were the clear Latin American leaders in online sales, billing more than US $17 billion and US $14 billion, respectively. Although their reign in regional e-commerce will remain intact for years to come, other economies are expected to see much faster growth. The forecasts of e-commerce sales in Argentina are expected to grow 153% between 2019 and 2024, compared to 121% in Peru. Latin America increased its e-commerce users by 30% during the pandemic, a growth that, without this crisis, would have been reached in 2022. With growth between 25% and 30%, Mexico and Colombia lead the increase in users. Argentina, on the other hand, a more developed market, is the one that grew the least during 2020, with a 5% increase. E-commerce growth expected 2019-2024: Argentina 153%, Brazil 74%, Mexico 70%, Colombia 92%, Peru 121%, other LAC 16% (Statista, 2019). As in the rest of the world, the products most in-demand in the first wave were items needed for the pandemic: masks, gel. After that, food, electronic products, and personal care were the most in demand. Undoubtedly, the health crisis caused by the coronavirus has been fertile ground to stimulate e-commerce transactions worldwide, resulting in an increase of 7% in the number of transactions compared to 2019, a value that represents an increase of US $4.4 billion dollars (UNCTAD, 2020).

The 120 websites analyzed have an average of 1.4 billion monthly visits. In addition, each visitor browsed through an average of 4.53 pages. On the largest e-commerce website, this number reaches up to 12 pages per visit on average. Users spend an average of 9 minutes and 26 seconds, a very high figure compared to those websites that fall into the electronic commerce category (Semrush, 2021). Colombia grew from 43% to 55% users of online shopping sites in 2020. In turn, Mexico increased from 46% to 60%, and Argentina grew from 63% to 68%. A total of 52 million new buyers used digital purchasing channels in LAC in 2020 (Semrush, 2021).

Marketplaces have consolidated especially for technology, home goods, sports, and mobile devices. In Brazil, 74% of retailers sell products and services through marketplaces, of which 8 out of 10 did so to increase their sales and complement their traditional sales. According to the Olist survey, 90% sell their products and services through Mercado Libre and 72% through B2W. In the case of Mexico, marketplaces have revolutionized the online market by promoting the change in the business model of several retailers. About 30% of Mexican retailers sell their products through marketplaces, with Amazon being the most used, followed by Mercado Libre, Linio, and Shopify. Most consumers in LAC still prefer Mercado Libre over Amazon and others, according to Comscore research (Epa.digital, 2019). In terms of visits per month, Mercado Libre (667 million), Amazon (169 million), Casa Bahia (129 million), Shopee (40 million), AliExpress (37 million), Dafiti (28 million), Netshoes (27 million), Extra (24 million), and Palabela (24 million) are recognized as the main players (Statista, 2021).

Overall, in the LAC region, e-commerce is hardly a general industry considering that only 21% of the population in 2019 accessed e-commerce services, and the e-commerce index score was 40, the second-lowest worldwide value after Africa, which had a score of 30 (UNCTAD, 2020). Countries that make the greatest use of e-commerce tools are Costa Rica, Chile, Brazil, and the Dominican Republic (UNCTAD, 2020), coinciding in most cases with those countries in the region that have experienced the greatest growth in the sector, as is shown in the following illustration.

FIGURE 4. REPRESENTATIVE CASES OF E-COMMERCE GROWTH IN LAC
(UNCTAD, 2020)



Considering the regional weakness in the reliability of postal services, companies dedicated to developing e-commerce activities have decided to transform this weakness into an opportunity. As a result, last-mile distribution systems are being developed integrating technologies such as artificial intelligence, drones, and IoT, expecting to strengthen the existing distribution chain.

In parallel, the development of initiatives to improve the customer experience and to strengthen e-commerce sites is being considered. For that, the use of augmented reality, or digital personalization techniques, will allow the flourishing of solutions such as livestream commerce and headless commerce (Forbes Colombia, 2021).

Energy

Energy production is considered one of the basic elements in digital transformation. Vehicles, industrial machinery, computers, and even humans depend on a constant supply of energy to work. Electrical energy catches special attention since it is the fuel that powers the growing number of emerging devices that consume electricity.

Access to electricity has been increasing since 1995. By 2019, 99.69% of the urban and 93% of the rural population in LAC had access to electricity, considered some of the highest penetration rankings in the world (World Bank, 2020). This expansion demonstrates that access to electricity is regarded as a pillar of the region's economic development.

Despite these optimistic numbers, not all populations can access electricity. Sadly, the most impoverished people in urban areas cannot access electricity, mainly due to their limited economic resources. In rural areas, the lack of access is caused by connectivity deficiency to the main electric grid (the known last mile issue) (IDB, 2019).

The described factors encourage regional governments to look for solutions that, supported by technology, provide enough market openness to digital transformation initiatives in the industry and thus reach all of the LAC population. Ecuador approved a law to ensure that all the electricity-related contracting processes are transparent, equitable, accessible and meet quality requirements. The regulations include supporting those projects related to the expansion of the power lines in rural areas, to reach those who do not have access to service. In the same way, Chile modernized the procedure for calculating electricity rates considering technical, legal, and economic factors, and with the participation of service providers in the process. In Brazil, the regulations for concessions in the electricity sector to private companies were modified, allowing private companies to enter into new contracts to provide electricity service. Finally, Costa Rica approved regulation that enables electricity companies to install and manage the supporting infrastructure for electric vehicles (OLADE, 2020).

When it comes to electricity generation, the LAC region is characterized by its high hydroelectric power generation (CEPAL, 2019). More than 45% of the electricity generated comes from this source (OLADE, 2020). However, other sources such as geothermal (0.7%), wind (6%), solar (1.5%), and other renewables (less than 1%), also have high penetration in the LAC market (OLADE, 2020), mainly motivated by technological advances in the sector that generate a reduction in acquisition and installation costs.

FIGURE 5. LAC ELECTRICITY GENERATION POTENTIAL (CEPAL, 2019)

LAC is characterized by high potentialities in electricity generation from renewable resources

- Hydropower uses 23% of its potential
- Geothermal power potentiality goes form 3600 to 15000 MW
- Wind power potentiality reaches 471000 MW
- Solar power mean potential is 500W/m^2

The agreements between countries in the region have made it possible to create interconnected electricity distribution networks, which in turn have met specific needs, thus avoiding prolonged gaps in the availability of electricity service. Some cross-border electricity systems in the region are shown below.

TABLE 2. EXAMPLES OF CROSS-BORDER SYSTEMS IN LAC (CEPAL, 2019)

COUNTRIES	CAPACITY (MW)
Bolivia - Peru	150
Colombia - Venezuela	150
Brazil - Venezuela	200
Colombia - Panama	300
Argentina - Chile	600
Brazil - Bolivia	1000
Ecuador - Peru	1000
Colombia - Ecuador	1500
Argentina - Uruguay	1890
Brazil - Paraguay	14000

DIGITAL TRANSFORMATION BASE IN LAC

Despite the great potential for generating electricity from renewable resources, LAC prices are relatively in the same range compared to developed countries like the Republic of Korea. In LAC the average price for one kilowatt/hour is US $ 0.12 (CEPAL, 2020), while in Korea it is US $0.13 (KEPCO, 2021). Pricing is a factor in digital transformation initiatives to provide efficiency to the sector and get the best benefits for the LAC population.

The need to control electricity transactions has motivated LAC electric operators to contemplate the implementation of advanced data analysis systems based on big data, data mining, and artificial intelligence, tools that allow fast learning of the trends of inter-border electricity transactions. Countries such as Brazil and Paraguay are the leaders in the region in the implementation of these types of initiatives (IDB, 2020).

Cloud computing is another technology that is being used to efficiently manage and control electronic transactions. Through its use, the sharing of information between companies or countries is efficiently conducted, contributing to the optimization of internal processes. In this sense, Peru has demonstrated a high level of maturity in the use of this technology, followed by Mexico and Brazil (IDB, 2020).

At the same time, there is a tendency to make users the central point of any technological innovation initiative. This has led several countries in the region to adopt an advanced metering infrastructure (AMI), facilitating the understanding of electricity consumption behavior, and at the same time generating awareness about responsible consumption. Barbados is the country in the region that shows the highest rate of adoption of this type of infrastructure (IDB, 2020).

Robotic process automation (RPA), which enables efficient use of resources, is gaining importance in the region's electricity sector. However, this technology has not reached the maturity levels achieved by countries such as Australia. In this sense, the country that has experienced the greatest progress in the region is Brazil (IDB, 2020).

Finance

The market for digital banks in LAC has the potential of reaching 650 million people in 33 countries. Considering the economically active population, around 250 million can be considered direct customers. Brazil and Mexico alone have a population of 340 million people and a GDP of US$3.1 trillion (Strange & Hafemeister, 2021), with an economic growth outlook of 5.2%, after the pandemic (Centenera, 2021).

The Brazilian examples show that from six of the top banks that concentrate 80% of the market on credits and deposits (Strange & Hafemeister, 2021), three are digital. This shows that, if service is good, the market response will be high. The customer's trust is key to success. In that market, the taxes on transactions and benefits of services are the key factors. Traditional banks are more trusted by older people, while younger people will trust the benefits, facilities and convenience offered by the top three digital banks: NuBank, XP and Stone. The fintech market is a growing one (Pickert, 2019).

The high penetration of the internet in the region motivates consumers to demand efficient and instant access to banking services. To meet this demand, LAC financial institutions are concentrating on developing web or mobile applications that provide a 100% digital, agile and reliable environment for consumers (Intelligence, 2020).

The introduction of chatbots that use artificial intelligence to provide customer service interaction is further evidence of the digital transformation in the region's financial sector. These intelligent systems significantly improve the customer experience as well as reduce related operational costs.

Finally, banking institutions are developing the strategy of becoming the central point for operations that involve the movement of money. Thus, they are upgrading their platforms to become the integrating element between banks, customers, and suppliers (Intelligence, 2020).

Healthcare

Between 2000 and 2017, the LAC region allocated an average of 2.4% points of GDP to health. This represents an increase of 49% for the entire period. The allocation average remained the same in 2018 and 2019 (CEPAL a, 2019). In 2020, CEPAL and PHO argued that it was required to increase fiscal expenditure up to 6% to control the pandemic and help the health sector in LAC (CEPAL-OPS, 2020). There were other measurements as evidence, such as the level of investment in the countries of the region (US $ 1,026 per capita), the proportion of health expenses attributed to direct out-of-pocket payments (34%), the prevalence of financial vulnerability (percentage of the population that spends more than 10% of income on healthcare (7.8%), and the percentage of population being pushed into poverty due to health expenditures (1.7%) (OECD, 2020).

Based on results of the Latin America and the Caribbean 2020 Health Overview, the health sector shows the following indicators: survival to age 65 for women (83.2%), survival to age 65 for men (73.8%), mortality rate under 5 years old (18.6/1,000 births). These provide an overview of mortality in LAC among adults and for children under 5 years of age (OECD, 2020). Moreover, health care coverage and services are measured by the availability of medical infrastructure (2.1 beds in hospitals per 1,000 people), human resources (2 doctors per 1,000 people, 2.8 nurses per 1,000 people, 3.4 psychiatrists per 100,000 people) and the coverage for mothers who receive at least four prenatal visits during pregnancy (87%) (OECD, 2020).

The gaps that exist in the LAC region are evident. According to the WHO, LAC countries have committed to expanding equitable access to comprehensive, integrated and quality health services, centered on the person, the family and the community. Strengthening the stewardship and governance of the national health authority, while promoting social participation, is also required. Moreover, it is necessary to strengthen human resources management and development in the healthcare field with skills that support a comprehensive approach to health. Another aspect is adequate and sustainable financing for health, with equity and efficiency, and protecting all individuals and their families against financial risks. It is important to ensure access to essential medicines and vaccines, as well as other priority health technologies, based on scientific evidence and the situation in each country. Also, governments need to work on strengthening health information systems to support evidence-based policies and decision-making; on reducing communicable diseases and eliminating neglected diseases; and on reducing health inequalities and inequities through intersectoral, multisectoral, regional and subregional approaches to social and environmental health factors (Pan American Health Organization, 2018).

The crisis generated by the coronavirus has highlighted the vulnerabilities of the healthcare industry in the region. Lack of collaboration, inaccessibility, manual processes or increasing costs (Garcia, 2019), have created the need to accelerate digital transformation processes. Considering this scenario, it becomes imperative to take action to digitize and transform this essential industry.

As part of the strategies to improve health care systems in the region, intelligent and collaborative ecosystems are being generated to establish governance, education and connectivity (World Bank, 2020, (b)).

The electronic health record, which already exists in countries such as Uruguay, Brazil, and Peru (Bastias-Butler & Ulrich, 2019), is a product in which intelligent ecosystems are being put into practice as the basis for creating telemedicine environments or applications to improve patient traceability. These actions helped mitigate the effects of social and hygiene issues in the pandemic (World Bank, 2020, (b)).

This is the case in Colombia, where the number of telemedicine services has increased by 192%, making it possible for vulnerable groups of people (pregnant women, the elderly, or people with pre-existing chronic diseases) to access health services in a standardized, safe and reliable environment (World Bank, 2020, (b)).

In the same way, there are other regional initiatives such as the one presented by the American Network for Cooperation on eHealth (RACSEL) that standardize the architecture and structure of medical data. The objective is to create an appropriate environment to reach the desired level of regional collaboration on health-related issues (Bastias-Butler & Ulrich, 2019).

The healthcare industry has taken advantage of the available cellular network and the high number of mobile devices in the region. For this reason, mobile telemedicine applications have been developed to make it possible to schedule an appointment or have a virtual consultation; these services are well appreciated, particularly in areas that are difficult to access (Chá Ghiglia, 2020).

2.3.

CHALLENGES AND OPPORTUNITIES IN LAC

LAC is a region that is making its best efforts to overcome its economic and social challenges and to acquire the benefits from newly created opportunities from digital transformation. Based on recent literature we identified the challenges and opportunities of digital transformation in LAC.

The agricultural industry in the LAC region is facing several challenges, ranging from the lack of knowledge associated with the management of information and communication technologies to the lack of resilience capacity, primarily motivated by the deficiency of communication infrastructure for supporting effective digital transformation. Agriculture is not digitally transforming at the expected speed and cannot meet the region's food demand (Trendov, Varas & Zeng, 2019). State and private companies are aware of these challenges, and seek to generate opportunities for changing the current agricultural operational and business models. Based on information technologies and training programs, the agricultural industry is on the way to achieving an effective transformation to increase productivity, sustainability and resilience to imminent climate change (ECLAC, 2020; Megido, et. al., 2019; Picado, 2021; Viton, et. al., 2019).

In the case of e-commerce, the coronavirus pandemic has highlighted the lack of preparation of retailers for a business model based on digital resources. The absence of systems in which financial institutions, merchants and customers converge has caused merchants that were not prepared to take their business online to suffer significant monetary and customer losses. (Ferrantino & Koten, 2019; Jaramillo, 2020). However, this lack of preparedness has created great opportunities and has placed e-commerce platforms as an additional element in business models. Governments are improving their regulations and laws to provide an enabling environment for e-business in an environment of legal and IT security for the benefit of businesses and customers. (Albrieu & Rapetti; Beylis, et. al.., 2020; Popkin & Reardon, 2018; Totolo & Baijal, 2020).

The Latin American and Caribbean region is characterized by high accessibility to electric power services, mainly due to many hydric resources. However, the region is highly dependent on fossil resources, especially in the transportation sector. The main challenges for the region are to move from a fossil-dependent model to an electricity-dependent model and go beyond an integrated electricity system to an integrated and intelligent system that is capable of providing clean energy solutions to those areas that are not yet served. Since smart energy systems are a relatively new topic in the region, there is not enough regulatory framework to regulate standards, roles, functions or prices for this type of technology (Balza, et al., 2016). The primary opportunity for the region's electricity sector is citizens' awareness of the need for responsible energy consumption, the importance of consuming energy from clean sources, and the need to optimize resources (Team, 2021).

One of the main challenges in the financial sector in the region is that most electronic banking transactions are taxed, discouraging the use of electronic banking services by users. Similarly, the perception of a lack of computer cybersecurity and the constant presence of fake banking portals generate distrust in the electronic financial system (UN, 2021). However, the new reality caused by the coronavirus has made consumers and banking entities resilient. They have transformed their platforms and included security mechanisms to prevent access to fraudulent sites or perform a detailed analysis of the identifying characteristics of users, generating greater trust between banks and their customers. As a result of improved security systems, it is possible to provide new online services such as loans, payment of services, electronic transactions, and integration with e-commerce platforms, reducing operating costs. (IDB & Finnovista, 2017; Estadao, 2021; Forbes, 2020; World Bank, 2021).

Finally, healthcare has been the sector that has experienced the most challenges in recent years. The pandemic has revealed that the existing technological architecture, governance mechanisms, and regulations are not sufficiently effective to support a digital transformation process in this sector. In the region, the main challenge is to achieve a convergent health environment, in which users' medical records are digitally available, with adequate information security and confidentiality (Bastias-Butler & Ulrich, 2019; Curioso, 2019). Each of these challenges brings a set of opportunities, such as the development of telemedicine and digital medical records, making the healthcare sector an industry propitious to develop digital transformation initiatives. (Oliveira et al., 2020; Rodriguez, et al., 2020).

TABLE 3. CHALLENGES AND OPPORTUNITIES OF INDUSTRIES IN LAC

Agriculture

CHALLENGES

The agriculture industry has several challenges to be overcome. Infrastructure and educational capabilities are the biggest issues in all countries, as summarized below:

- Most of the solutions implemented are not sufficient to meet demands
- Small and medium enterprises have difficulty overcoming the IT development stage
- Need for focused training

(Trendov, Varas & Zeng, 2019)

OPPORTUNITIES

Many countries in LAC have opportunities focused on the IoT, big data and the connectivity of networks, mostly associated with education, and acknowledging the known challenges. The most common opportunities for projects underway now and in the near future include:

- DX technologies like IoT and big data to increase productivity, sustainability and resilience to climate change in the agricultural sector, through technology
- Connectivity of networks
- Education on the management and use of DX technologies
- IoT, drone surveillance, satellite image analysis, food sensors, big data and blockchain
- Data analysis training for decision-making
- Investments in ongoing projects, such as Mexico's "PREEMAR," Ecuador's "EL ORDENO," and Brazil's "AGRO TRACE"
- DX technologies to run farms, manage accounts and cash flows, control regulatory standards and help with understanding and payment of taxes, logistics, tracks, minimizing production costs, and improving farm profitability

(CEPAL, 2020; Megido, et. al., 2019; Picado, 2021; Viton, et. al., 2019)

E-commerce

CHALLENGES

E-commerce grew exponentially after the Covid situation. This exposed the challenges in LAC, not only in infrastructure, but also in specialized services and education, as follows:

- Low percentage of broadband internet access causing digital exclusion
- Needs in ICT Infrastructure and services, payment solutions, trade logistics and trade facilitation, E-commerce skills development, legal and regulatory frameworks, and access to financing

(Ferrantino & Koten, 2019; Jaramillo, 2020)

OPPORTUNITIES

Improving services, infrastructure and the growth of capabilities are the most common opportunities to the industry. Great projects are already underway, but improvements are still needed. DX is taking place, and the top opportunities in all LAC countries are:

- New second-generation platforms to meet the increasing demand for e-services without degrading the quality of customer support
- Infrastructure and platforms to small companies, independent contractors, and informal workers
- Retail and wholesale employment represent 20% of the workforce in LAC, and 65% of it can be digitized
- More online platforms to reach millions of customers
- Integration of DX with the agriculture industry to improve the reach of the market
- Replicate and improve local projects, such as Costa Rica's "COOPER BORBON," the Columbian "LA CANASTA" and the Chile online agricultural market

(Albrieu & Rapetti; Beylis, et. al.., 2020; Popkin & Reardon, 2018; Totolo & Baijal, 2020)

Energy

CHALLENGES

Some countries in LAC are already developing and improving the electrical grid, facing challenges from basic issues to intermediate ones, as noted below:

- LAC has 4% of the population lacking access to electricity, the majority in rural and remote areas
- Continuous use of solid fuels and coal for lighting and heating homes, schools, health centers, etc.
- Some LAC countries are focusing their resources and policies on ensuring sufficient energy to meet basic needs;
- Difficulties in implementation of smart grids (high costs, regulatory barriers, lack of open standards)

(Balza, et. al., 2016)

OPPORTUNITIES

Increasing the grid and the smartness of the energy industry is happening. The DX opportunities in LAC are, in their essence, investments in infrastructure, improving services and upgrading existing ones, in all parts of LAC:

- DX services to provide citizen awareness of energy consumption
- Energy smart grids
- Use of clean energy, solar panels, or wind power stations
- Energy security and socio-environmental sustainability
- Decentralization, decarbonization, and digitalization
- Smart meters for homes
- Big data analysis for energy-related solutions and improvement

(Team, 2021)

Finance

CHALLENGES

The LAC finance industry is developing new services and business models to increase scope in national and international markets, but it faces the following challenges:

- Difficulties in finding profitable, sustainable models that facilitate market segmentation and overcome potential regulatory issues
- Difficulties in providing countries with a set of innovative instruments such as developing applications or platforms aimed at increasing productive, economic and financial capacity

(UN, 2021)

OPPORTUNITIES

The shift to smart platforms is a priority for the finance industry in LAC, as it provides the following opportunities:

- Migrating faster to new platforms
- More digital banks
- Focused services for crowdfunding, P2P transactions, digital loans, digital currency, mobile payments, digital account and transactions, security and reliable applications, biometrics, smart devices, and smart management as platforms of digital context
- Digital bank solutions for e-commerce companies
- DX trading system, pension system
- Offer services with lower costs, more efficient transactions and safer environment, trading platforms
- Direct connection of consumer and suppliers to facilitate the transactions
- Logistics solutions for all kinds of low-skill workers

(BID & Finnovista, 2017; Estadao, 2021; Forbes, 2020; World Bank, 2021)

Healthcare

CHALLENGES

LAC countries face several challenges to increase health services through DX tools, such as those below:

- Lack of focused training to adopt DX
- Need for vision, mission and national plan adoption by LAC governments
- Resistance to IT changes by health professionals
- Governmental adoption of 1) governance, 2) ICT architecture 3) management of people and programs 4) standards and interoperability

(Bastias-Butler & Ulrich, 2019; Curioso, 2019)

OPPORTUNITIES

Countries in LAC have made efforts to develop and implement new services and products related to DX within the healthcare industry, from which many opportunities have arisen, including the following:

- Telemedicine transition
- Clinical process integration
- DX health and well-being focus projects
- Digitalization of infrastructure and sanitation services
- Smart water management systems
- Circular economy to use water from alternatives sources, like rain
- Use of wastewater as an economic opportunity

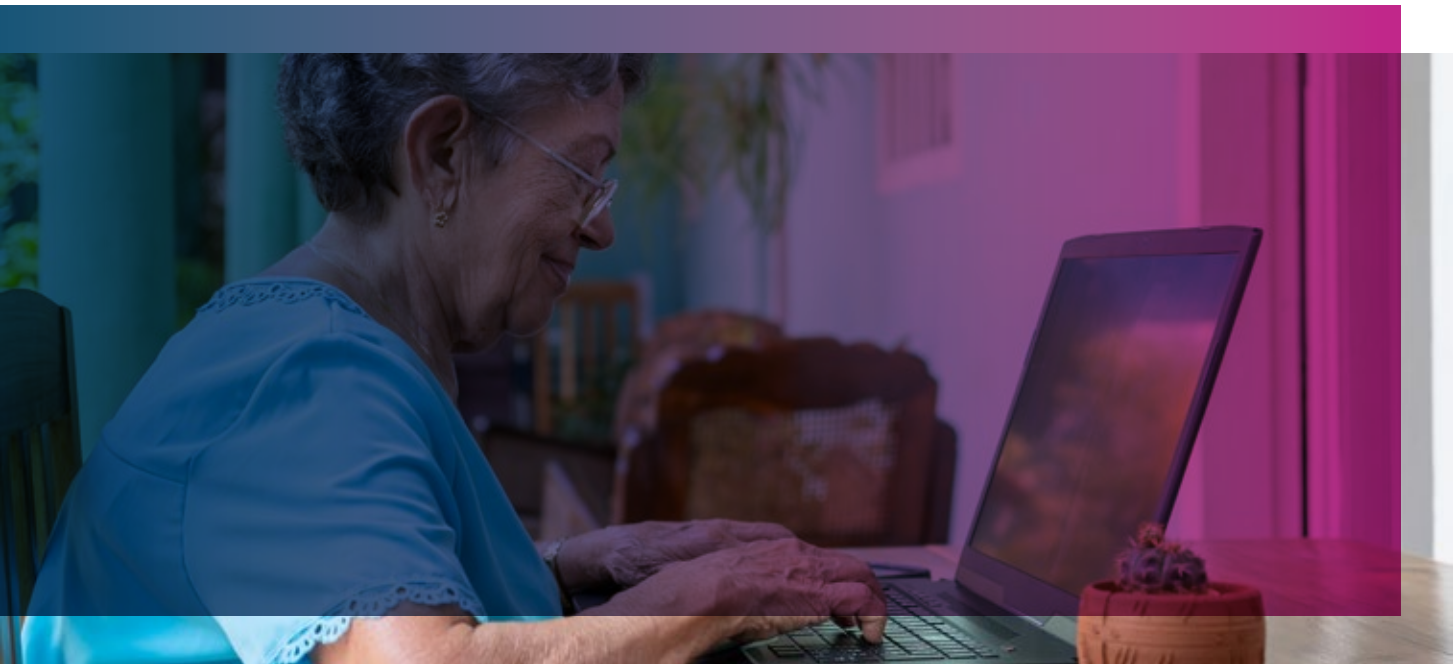
(Oliveira et al., 2020; Rodriguez, et al., 2020)

DIGITAL TRANSFORMATION BASE IN LAC

In recent decades, we have seen that the internet is the vehicle that supports digital transformation (CEPAL, 2020a); however, despite the efforts made by the governments of the LAC countries, this service does not reach the majority of the region's inhabitants.

It is human nature to simplify tasks (Leiva, 2005), such that this trend is reflected in theories of technological convergence. Nowadays, we use convergent devices such as smartphones that allow us to meet our needs in an agile and timely way. The explosion in the diversity of models and functionalities of these devices has caused the penetration of smartphones in the regional market to reach 84%, creating the need for private companies to make investments to enhance the quality of service or expand the coverage area. As a result, mobile broadband coverage has reached 96% in the region (López-Calva, 2021).

Without underrating the importance of the internet, there are socioeconomic factors such as people and capital that impact the speed of digital transformation. In this sense, without human talent properly trained to manage or use the available technology, the effort made by industries to achieve an effective digital transformation will be limited. Industry leaders know about this need and pose it as a challenge, so they offer attractive job positions in their industries for those who know how to handle technology. However, not only managers are aware of this need, LAC governments and citizens recognize the importance of technical education to increase the competitiveness of countries, improve the productive structures and take advantage of digital transformation (SITEAL, 2019). This fact is illustrated by the increasing growth rate of students following technical careers in the LAC region in 2020 compared to previous years.



However, this growth is not fast enough to match the required skills, forcing regional industries to make investments to absorb companies that have the talent required. Some examples are shown in the table below.

TABLE 4. REGIONAL INITIATIVES TO FILL THE GAP OF TECHNICAL TALENT (ATLANTICO, 2020)

ifood	• iFood acqui-hires Brazilian startup for AI talent
Loggi	• Loggi acqui-hires WorldSense
Gympass	• Gympass buys Portuguese artificial intelligence startup
nubank	• Fintech Nubank acqui-hires Plataformatec and its team of engineers • Nubank acquires US technology company Cognitect

Naturally, transformation processes involve resource consumption, and digital transformation initiatives are not excluded, with capital being the most required element. Fortunately, for the LAC market, venture capital investment has been increasing. Comparing 2011 to 2019, this investment has grown 53%. This growth is mainly motivated by the success of unicorn enterprises in the region such as Mercado Libre, Pago Seguro, B2W, and NUbank, among others (CEPAL, 2021). In this regard, Brazil, Colombia, and Mexico are the three countries with more relevance in the development of the digital economy, making heavy capital investment in startups, with a value that reached US $4.6 billion by 2019 (World Economic Forum, 2020).

The combination of technical and socio-economic factors has determined that public and private companies represented by the agricultural, health and financial industries, among others, are taking the best advantage of the technology, including in their business models digital elements that are revolutionizing the way of doing business as well as boosting their productivity. As a result, the sectors that have implemented digital technologies are enhancing their digital maturity giving as a result, increasing revenues and benefitting from improved decision-making environments, making them able to compete against digital natives and peers (World-Economic-Forum, 2016).

The potential of digital transformation and the fear of digital gaps coexist

LAC organizations are developing digital transformation initiatives oriented to reduce the effects of the digital gap. In effect, if LAC continues developing digital transformation initiatives, a positive impact will be generated on the regional productivity of over 2.5% for the following years; considering that, due to the coronavirus pandemic, in 2020 regional productivity fell by 7.4%, the biggest decrease since 1821 (IDB, 2021). However, different transformation speeds also generate negative effects such as the broadening of the digital divide between industries and nations. (World Bank, 2016).

Furthermore, as a result of the coronavirus pandemic, the digital transformation process in the region has been accelerated in such a way that in a few months it has evolved in what would have taken three to five years. The digital landscape in the region is growing exponentially, making it an ideal scenario for the generation of great opportunities for digital growth and innovation compared to economies in other regions (BBVA, 2021). The unexpected pressure generated by the pandemic on the productive sectors of the region has motivated the adoption of mitigation and adaptation strategies through digital transformation mechanisms, allowing a constant provision of goods and services that have been degraded and have become scarce or inefficient.

3. CASE STUDY
DIGITAL TRANSFORMATION IN KOREA

3.1.

KOREAN DIGITAL CAPABILITY GROWTH PROCESS

Korean digital capability

Korea has become one of the countries with the fastest average internet speed and highest smartphone utilization rate, and its capital, Seoul, is rated as the most advanced and well-working e-Government (UNDP, 2020). Everything is connected to the network, and Korea is the first nation to utilize 5G telecommunication services with a huge number of telecommunication users. Korea's digital transformation is still proceeding at an accelerated pace.

South Korea ranked second in the Asia Digital Transformation Index among the 11 surveyed countries in the Economist Intelligence Unit (EIU), placing it as a clear leader with crucial strength in all three index categories. In human capital development, Korea is ranked first on the index list, due to the harvest of educational and long-run policies aimed to supply a highly skilled technology workforce trained at home and overseas.

FIGURE 6. THE KEY INDEX PERFORMANCE OF KOREA (EIU ASIAN DIGITAL TRANSFORMATION INDEX)

#2	#2	#1	#4
OVERALL	DIGITAL INSFRASTRUCTURE	HUMAN CAPITAL	INDUSTRY CONNECTIVITY

According to IMD World Competitiveness Centre,[2] in the Digital Competitiveness Index Ranking 2020, Korea is in the 8th position among 64 surveyed countries. This is an improvement of five positions since 2016 (IMD, 2020).

FIGURE 7. DEVELOPMENT INDICATORS OF LAC AND KOREA

OVERALL RANK		KNOWLEDGE	TECHNOLOGY	FUTURE READINESS
1	USA	1	7	2
2	Singapore	2	1	12
3	Denmark	6	9	1
4	Sweden	4	6	7
5	Hong Kong SAR	7	2	10
6	Switzerland	3	11	5
7	Netherlands	14	8	4
8	Korea Rep.	10	12	3
9	Norway	16	3	6
10	Finland	15	10	9

[2] https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2020/

1st

e-Participation and internet retailing

3rd

Business agility

3rd

Future readiness factor

1st

Adaptive attitudes

5th

In East Asia and the Pacific region, behind Singapore

6th

One of the world's innovation hubs

10th

In pillars and leads the world in ICT adoption

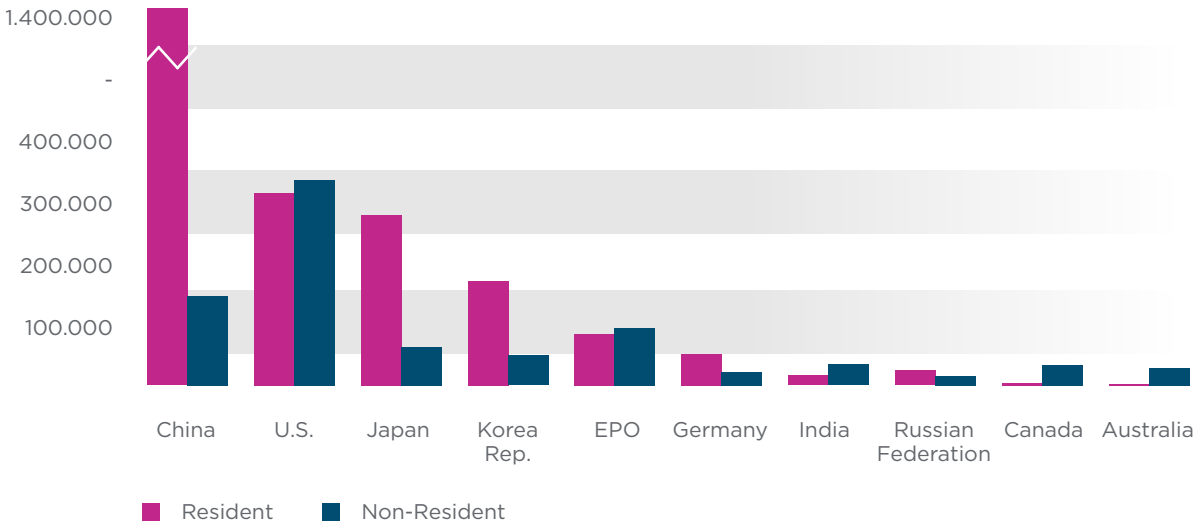
- Korea boasts the most fiber optic connections per capita in the world.
- 96% of the population uses the internet on a regular basis.
- Korea obtained the world's best mark on the macroeconomic stability pillar.

"Korea improved across all factors. Its strongest performance comes in the future readiness factor (3rd), specifically in the adaptive attitudes (1st) and business agility (3rd) sub-factors. In adaptive attitudes, it ranks 1st in e-participation and internet retailing. In business agility, Korea benefits from a positive turn in executives' perceptions, particularly in terms of how enterprises manage opportunities and threats, the agility of companies and their use of big data and analytics."

(IMD, 2020).

There is strong belief and evidence that technology drives the economy, and one key sector is ICT. The aforementioned proof is the new position of Korea in the international patent rankings published by WIPO in the World Intellectual Indicators. In the last issue Korea is ranked in the 4th position. "The Republic of Korea's office saw a second successive year of growth in applications. Among the top 20 offices, 11 had a greater number of patent applications in 2019 than in 2018" (World Intellectual Property Organization, 2020).

FIGURE 8. PATENT APPLICATIONS AT THE TOP 10 OFFICES (WIPO, 2018)



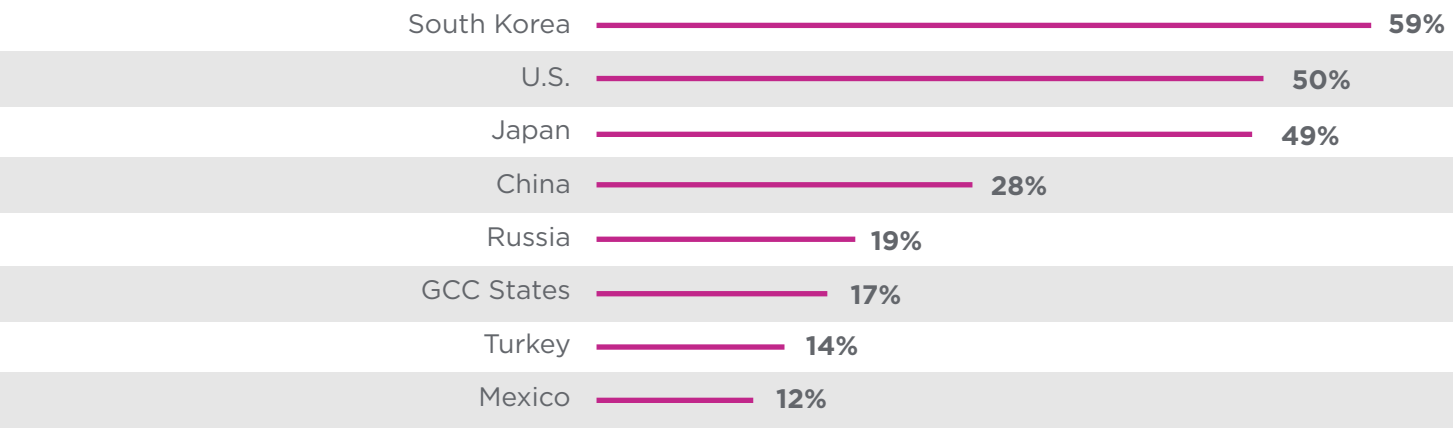
Establishing a long-term vision for technology is the first strategy in which each country needs to engage. In this sense, they will be considered as a potential catalyzing element of the economy in terms of generating employment, stability, income, use of capital, and being part of productive chains, as well as a strong consumer of technologies with high rates of productivity.

In the Korean case, commitment to technology began early, in the late 1980s, and remained constant while being linked to a dual purpose: modernization and economic development. Since the late 1980s, foundations have been laid with industrial automation. The turning point, however, was perhaps the creation of an administrative information highway in 1994, motivated by the Information Superhighway Project in the United States in 1993. This was accompanied by the establishment of the Ministry of Communication (MIC), which was one of the first ICT ministries in the world, when the internet was still in its infancy (Sharpe & Self, 1993). Since the end of the 1990s and the beginning of the 21st century, there has been a continuous and constant vision and agenda (Park & Suh, 2011).

In 2003, the Korean roadmap for e-Administration was published, composed of four innovation areas, 10 agendas and 31 projects, and the Committee on Promoting Administration Computerization was set up in the National Assembly (Park & Suh, 2011). The key principles of this document have been maintained, with few variations since then. Since the late 1980s, a structure composed of various players and political leaders drove the significant evolution of regulations and plans. Later, in the 90s, The interconnection between administrations took place, and finally, at the beginning of the century, a plan of 11 e-Government initiatives was launched.

These initiatives are partly carried out by the Ministry of Science and Technology for innovation, the Ministry of the Interior (e-Administration), Parliament and the Presidential Office (Park & Suh, 2011).

FIGURE 9. 5G MOBILE SUBSCRIPTIONS IN COUNTRIES (STATISTA, 2020)



Among the developed countries, Korea is the most connected or "hyper-connected" country in terms of ICT technology and network breakthrough, with a unique high-speed infrastructure based on 5G technology available far and wide in the country and high rates of internet use by businesses and individuals alike.

Endless challenges

According to a KOITA (Korea Industrial Technology Association) survey conducted with over 49 major companies and 1,296 SMEs, just 9.7% of Korean firms are actively involved in digital transformation, and of these, 63.1% focus on work process efficiency, 45.1% on enhancement of smart manufacturing, and 44.7% on new business creation.

FuturePlay is one of the largest Korean technology accelerators. One of its partners, Oh-hyoung Kwon, has said that a high-quality infrastructure does not reflect the Korean businesses pursuing digital transformation. A survey conducted by EIU (The Economist Intelligence Unit) determined that Korean executives do not necessarily believe that the outstanding Korean index provides information related to a supportive environment. From this survey, only 13% of the respondents agreed that satisfactory development in the transformation environment is "very successful."

The new policy to overcome challenges

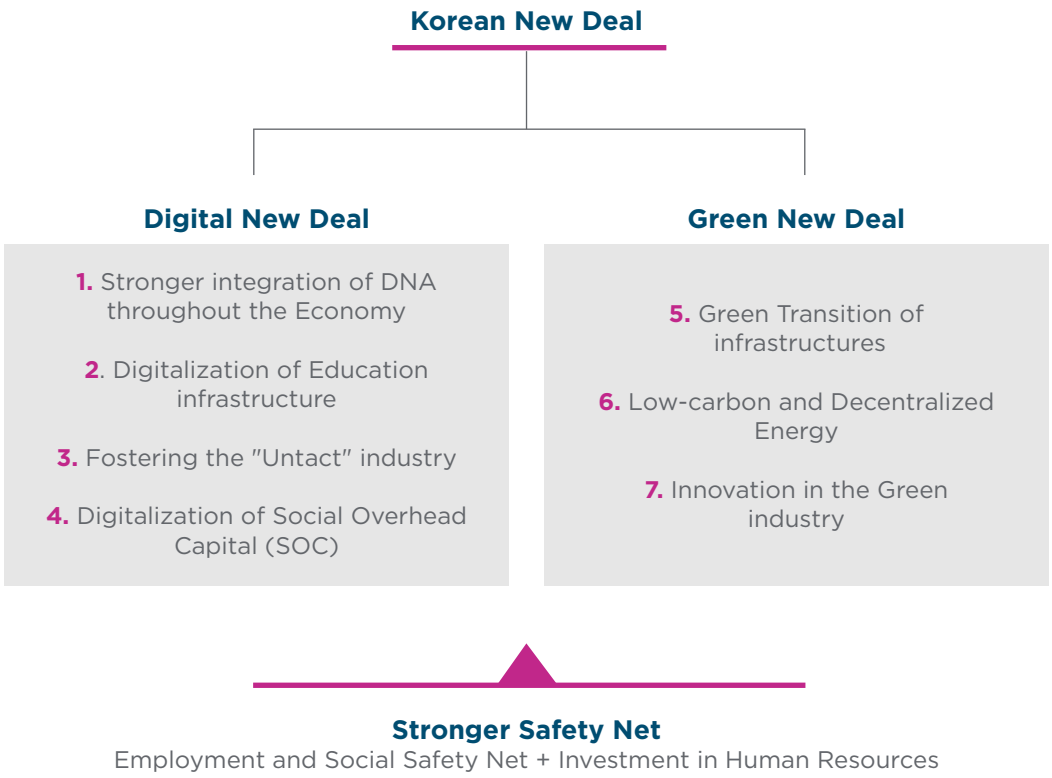
Korea has invested a considerable amount of time and resources from early on and remains committed to following the development track, demonstrated by the "Korean New Deal," which enacted an investment of 58.2 trillion won just for the labor sector with the specific target of boosting the digital transformation labor readiness. In the economy of digital transformation, 31.9 trillion won will be invested in big data, data integration and artificial intelligence (AI). Korea also announced the investment of 2.1 trillion won for "untact[3]" industry and 10 trillion for digitizing the social capital.

The main objectives of the Korean New Deal are:

- Stronger integration of data, network and artificial intelligence throughout the economy
- Digitalization of education infrastructure
- Fostering the "untact" industry (doing things without direct contact with others, such as using self-service kiosks, shopping online or making contactless payments), including supporting online activities of microbusinesses and promoting remote working among SMEs.
- Digitalization of social overhead capital (SOC).

[3] 'Untact' – a combination of the prefix 'un' and the word 'contact' – has been floating around in marketing circles since 2017. It describes doing things without direct contact with others, such as using self-service kiosks, shopping online or making contactless payments. Some believe this is a natural progression in a modern society like South Korea, which combines robotic baristas, virtual make-up studios and digital financial transactions with an ageing population and a shrinking labor force.

FIGURE 10. THE KOREAN NEW DEAL OUTLINE



Korea is finding new ways for the next move

New actionable plans are driven by the government, with ministries including the Ministry of Science and ICT, Ministry of Trade, Ministry of Industry and Energy, Ministry of Land Infrastructure and Transport and others, for planning sustainable development and electric vehicles. The Ministry of Environment is working on initiatives planned as ministries working together, and nationwide agendas with specific roadmaps (Korean New Deal) and investments for smart cities, digital transformation, artificial intelligence and other fields (UNDP, 2020).

So far, we have looked at detailed cases and processes of how Korea has grown its digital capabilities, and looked at the current status of Korea's digital capabilities and innovation. In the next chapter, we will introduce how Korea's policies have evolved, how it organized its national strategy, and explain how it was able to become a model case for the present day.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3.2.

THE DEVELOPMENT OF AN INNOVATION ECOSYSTEM IN KOREAS

As is well known, Korea has achieved rapid economic development, and ICT is one of the most important foundations for Korea's economy and society today. How did Korea overcome various challenges while it has leapfrogged development in the ICT sector and evolved its digital ecosystem? What are the success factors of Korea's informatization, which serve as the foundation for digital transformation today? By sharing Korea's experience and knowledge for informatization and development of the ICT industry and deriving the main success factors, this work is intended to provide useful lessons and implications for LAC countries.

TABLE 5. MAJOR ICT-RELATED INTERNATIONAL INDICES

INDEX NAME (NAME OF EVALUATING ORGANIZATION)	**KOREA'S RANKING** (NUMBER OF SURVEYED COUNTRIES)											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
ICT Development Index (ITU)	1 (152)	1 (155)	1 (157)	2 (166)	-	1 (167)	1 (175)	2 (176)				
Global Competitiveness Index-ICT adoption (WEF)									1 (140)	1 (141)		
e-Government Development Index (UN)	1 (192)	-	1 (190)	-	1 (193)	-	3 (193)	-	3 (193)			
E-Participation Index (UN)	1 (192)	-	1 (190)	-	1 (193)	-	4 (193)	-	1 (193)			
OURdata (Open, Useful and Reusable Data Index) (OECD)						1 (30)	-	1 (31)				
World Digital Competitiveness Ranking (IMD)								19 (63)	14 (63)	10 (63)		
International Digital Economy and Society Index (EC)				13 (45)	13 (45)	12 (45)	2 (45)					
Bloomberg Global Innovation Index						1 (50)	1 (50)	1 (50)	1 (50)	1 (50)	2 (60)	1 (60)

DIGITAL TRANSFORMATION IN KOREA

Korea's digital transformation ecosystem can be described with strategic actions and is summarized in the figure below. First, in terms of the policy process, Korea's digital transformation ecosystem displays the characteristics of a government-driven model. The strong government leadership and commitment, specifically the role of the Ministry of Information and Communication (MIC) as the policy "control tower" in the ICT sector, has played a leading role in Korea's ICT-led development since the 1980s (Larson and Park, 2014). Meanwhile, there also exist various designated funds including the ICT Informatization Fund and Broadcast Development Fund that promote the establishment of ICT infrastructure, education and training of the ICT workforce as well as R&D in ICT products and services. In addition, various designated agencies were established to facilitate the development and convergence of ICT technologies. Finally, the Korean government created the initial demand for the ICT industry in the informatization process by sharing risks with the private sector through various public-private partnerships in technology R&D projects and large-scale investment in infrastructures (Lee, 2021).

The digital ecosystem of Korea can be characterized by high levels of R&D investment from both public and private sectors, a highly educated workforce, a sound innovation framework with conditions that are still improving, large knowledge-intensive and internationally competitive firms, and a strong ICT infrastructure.

FIGURE 11. THE DIGITAL TRANSFORMATION ECOSYSTEM OF KOREA

Government-driven model

- The government's financing strategy "invest first, settle later"
- National Informatization Master Plans reflecting internal and external changes
- Improving innovation framework conditions
- Designated Ministry for ICT (Ministry of Information and Communication (MIC)

Government funding for R&D projects and ICT skill training programs

- Informatizacion Promotion Fund (IPF) (1993)
- Information and Communication Promotion Fund (ICPF)(2020)
- Funding for the IPF came from the private sector

DIGITAL TRANSFORMATION ECOSYSTEM

Public-private partnerships

- Large-scale investment in technology R&D and ICT infrastructure
- A gradual shift from the government development approach towards private sector-led model characterized by market-based competition, privatization and deregulation of telecommunication businesses

Human resource development in ICT

- IT Education for 10 Million Citizens Project
- Informatization education support for the disabled, females and soldiers
- Highly trained ICT professionals
- Korean Massive Open Online Courses (K-MOOC) on AI and robotics for the general public

The national informatization strategy that Korea has pursued over the past 40 years can be characterized as follows: (a) a paradigm shift in ICT policy, (b) establishment of ICT-related government agencies, (c) government leadership in the development of ICT technology and human capital, (d) enactment of ICT-related laws, and (e) public-private cooperation. The following subsections describe the process of how Korea achieved the basic foundations for digital transformation.

3.2.1.

A PARADIGM SHIFT IN ICT POLICY

Global competition in building high-speed information infrastructures in the early 1990s led Korea to also catch the wave and focus on building high-speed information infrastructure and establishing an informatization implementation system. This was led by the Ministry of Communications (MOC), which was later reorganized into the Ministry of Information and Communication (MIC) in 1994. Their plan aimed to establish a high-speed communication network by 2015. This project differed from previous attempts in that the scope was expanded to not only the public sector but also individual users in the private sector. The Asian financial crisis also prompted the Korean government to push strategies that could help create citizens that were IT literate and make Korea "a country that uses computers the best."

The Framework Act on National Informatization formulated the National Informatization Master Plan, reflecting internal and external changes in the environment, demand and technological progress. The following table shows the history and progress of the national informatization master plan.

TABLE 6.
HISTORY AND PROGRESS OF NATIONAL INFORMATIZATION MASTER PLAN
The table contents updated based on MSIT (2017)

MASTER PLAN PHASE	CONTENT
Phase 1: **Informatization Promotion Master Plan** (1996 - 2000) Preparation for foundation	• Selection of the 10 major tasks including education, administration, etc. • Establishment of information super highway, cultivation of IT and communication industries, etc.
Phase 2: **Cyber Korea 21** (1999 - 2002) Informatization Promotion	• Vision and strategies of a knowledge-based country • Establishment of information infrastructure, cultivation of new industries and creation of jobs, promotion of demand base expansion through informatization, education, etc.
Phase 3: **e-Korea Vision 2006** (2002 - 2006) Advancement by field	• Promotion of performance-based informatization such as enhancement of productivity exceeding quantitative expansion • Enhancement of infrastructure, promotion of first-class IT industry, reinforcement of international cooperation, etc.
Phase 4: **National Informatization Master Plan** (2008 - 2012) Link integration	• Realization of advanced knowledge/information-based society of creativity and trust • Five major goals: Creating Web 2.0-based websites wth open architecture, cutting-edge digital convergence infrastructure, information society of trust, knowledgeable government at work, and people well-versed in the digital society
Phase 5: **National Informatization Master Plan** (2013 - 2017) Convergence and Spread*	• Strategy to achieve creative economy and national satisfaction through creative utilization of ICT • Developing a creative economy through informatization, creative utilization of ICT by national society, reinforcement of people's creative ability, and enforcement of infrastructure to create a digitally transformed Korea, etc.
Phase 6: **National Informatization Master Plan** (2018 - 2022) Intelligence	• Prosperity through information-based intelligence for Korea • Paradigm shift in the nation's use of information technology toward an intelligent, hyper-connected, information-based nation in response to the Fourth Industrial Revolution

Shift from public sector computerization / telecommunication policy into informatization policy

The shift to informatization took place in the 1990s. The most notable shift in direction that happened in 1996 was the formation of the Informatization Planning Office and the Informatization Promotion Committee. These two organizations contributed to making informatization a government policy with more focus. This change also contributed to Korea noticing the importance of informatization and the underlying information technology behind it.

President Kim Young-sam and Kim Dae-jung held extensive meetings on informatization promotion and informatization strategy, which strengthened the will of the public and the private sectors to promote informatization.

The major laws implemented in the 1990s focused on acts that included plans for funding and promoting informatization, which ultimately started the momentum to shift the paradigm of ICT policies from “public sector computerization policy” or telecommunications policy” to “informatization policy.”

Additional related laws that were enacted included laws that prevent violation of privacy and laid the foundation for electronic transactions in the future.

Shift from informatization promotion to utilization of knowledge and information

Korea had entered the advancement stage of informatization by the 2000s, and the focus of informatization changed from informatization itself to focusing on the achievements that came from the utilization of informatization.

The biggest change in this decade was the abolishment of MIC, which had been the central agency of Korea for informatization. MIC's functions were then distributed among four agencies: Ministry of Public Administration and Safety (national informatization), Ministry of Knowledge Economy (IT industry), Korea Communications Commission (broadcasting and communications network and services), and Ministry of Culture, Sports and Tourism (digital content). The response to this decision was mostly negative, due to concerns of confusion and conflict, which could lead to the weakening of policy coordination functions in the implementation process for ICT policies.

Meanwhile, the Informatization Promotion Committee was replaced by the Committee on National Informatization Strategy. This new group was a public-private joint committee and was launched in 2009.

Policies were revised starting in 2009 for about two years, which created a new direction from "informatization promotion" to "utilization of knowledge and information." For example, the Basic Act on Informatization Promotion was revised to the Basic Act on National Informatization in 2009. Additional laws enacted in this period helped promote the IT industry and extend the scope of information protection from public institutions/information processed by computers to add the private sector/information on paper documents.

Shift from network infrastructure promotion to data-infrastructure promotion

By 2013, infrastructure for a high-speed network had already been established in Korea, so there was a movement to make a second leap forward and become a global ICT leader. Emphasis on the Fourth Industrial Revolution and preparation for a "hyper-connected intelligent society" became the focus. The infrastructure planned for this period became IoT, cloud and blockchain. These are essential infrastructures for gathering data.

Converging ICT into other industries was emphasized to make new businesses and social values, so there was a significantly increased interest in policies related to artificial intelligence.

A noticeable change during this period was the agency managing ICT. The formerly dispersed four agencies re-merged into one in 2013 called the Ministry of Science, ICT and Future Planning. During the Moon Jae-in administration (2017-present), it was renamed once again to the Ministry of Science and ICT (MSIT).

The laws during this decade focused mainly on the protection of personal data, which was in preparation for a more data-driven Fourth Industrial Revolution.

3.2.2.

GOVERNMENT LEADERSHIP AND COMMITMENT

Success in development of the ICT sector lies in the strong leadership of the government and its continuous investment in ICT infrastructure and human resources. Throughout the process of Korea's informatization, the Korean government played a crucial role in the development of the ICT industry by subsidizing the export of ICT products as well as providing direct funds for R&D projects and ICT skills training programs (Jeong et al., 2014). How did Korea finance the needed funds for the development of the ICT industry? This chapter will review the unique funding mechanism of Korea's ICT Promotion Fund and the history of Korea's human resource development in ICT.

Meanwhile, the government's investment in human resources greatly contributed to the promotion of nationwide digital literacy and transformation of non-IT human resources to IT specialists. After the Asian financial crisis, the Korean government pushed forward the CYBER KOREA 21 (1999.3) to promote the ICT industry as an engine for improving national competitiveness. To this end, the government promoted nationwide IT skills training programs for citizens, to make Korea "a country that makes the best use of computers worldwide."

The ICT skills training programs for the general public, which included the disabled, senior citizens and housewives, significantly contributed to the rapid spread of broadband. Meanwhile, advanced courses were provided for public officers, teachers, soldiers and company workers while promoting the use of personal computers by supplying equipment and free internet service at schools, developing affordable models of personal computers in partnership with manufacturers, and providing free PCs for low-income families and digitally vulnerable groups. In addition, the government created partnerships with private computer academies, universities and welfare organizations aligned with the mass digital literacy campaigns throughout the 1990s.

The Informatization Promotion Fund and its unique funding mechanism

The Informatization Promotion Fund (IPF), established in 1993 under the Informatization Promotion Committee (IPC), was used to financially support national informatization projects, develop ICT infrastructure, support human resource development and promote R&D in the ICT industry, which mainly consists of two sectors: telecommunications services and ICT equipment. While various reforms were introduced in ICT regulations to promote the development of telecommunications services, the Informatization Promotion Fund supported enterprises that developed ICT equipment by lending funds at low interest rates and conducting joint R&D in the ICT equipment sector. The government's financing strategy, "Invest first, settle later," created systems for pre-investment and post-settlement and attracted private sector investment, enabling a PPP-based funding mechanism by sharing financial burden as well as research outcomes between the public and private sector.

Specifically, the Informatization Promotion Fund was used for major ICT projects including the development of CDMA (Code-Division Multiple Access) and TDX (Time Division Exchange), the Korean Information Infrastructure (KII) Project and subsequent e-government projects as well as ICT workforce education and training programs such as the 10 Million Citizens Project.

Particularly in the initial phase of Korea's ICT policy in the 1990s, R&D and production of ICT equipment were undertaken in a public-private partnership and relied heavily on government funding and government-funded research institutions. For example, the government organized and controlled the whole process of R&D and production of CDMA and the electronic switching system, which is referred to as TDX. Meanwhile, the Electronics and Telecommunications Research Institute (ETRI), a state-funded research organization, was established to conduct various R&D activities including the development of Korea's first 32K ROM and TDX. Such specialized public institutions had the appropriate knowledge and expertise to develop ICT equipment in partnership with the private sector using the IPF.

The IPF was also used for the development of large-scale ICT infrastructure. Under the 10-year "Master Plan to Promote Establishment of Information Super Highway" that was established in 1995, the Korean government concentrated all its capabilities on establishing information superhighways, constructing fiber optic networks in 144 regions nationwide and broadband networks in 1,400 rural areas. The government has invested a total US $620 million in establishing the Korean Information Infrastructure (KII) test-bed and the KII-G (Government) network, which provided a physical basis for various e-government projects in the early 2000s. The KII-G network has been used by more than 30,000 governmental organizations, including central and local administrative offices, educational and research institutes, and medical institutes, at a discounted price.

Funding for the Informatization Promotion Fund came from the private sector, namely profits made by telecommunications companies instead of using foreign investment. In the meantime, the government encouraged private investment for early establishment of information superhighways by supporting a competitive telecommunications market. This method of funding was considered very successful in that the government was able to reinvest in R&D and infrastructure projects through recouping the costs by charging fees for the use of administrative networks such as the KII network.

In 2005, the IPF was abolished as the national goal to construct the information superhighway was successfully achieved, and an Information and Communication Promotion Fund (ICPF) was established with the goal to financially support R&D, standardization and HRD for the promotion of the ICT industry. In 2021, 1.7 trillion won from the ICPF was allocated to the "Digital New Deal," which aims to further strengthen its digital capacity and promote growth in promising "untact" industries as the outbreak of the COVID-19 has accelerated transition toward a digital economy. It heightens the competitiveness of Korea and its industries by establishing digital infrastructures in areas such as data, network and artificial intelligence (DNA). At the same time, major infrastructures including those for transportation, water resources, urban planning and logistics will be digitized. More specifically, the government plans to build large-scale ICT infrastructure including a "Data Dam 15," which promotes a data-driven economy including the collection, standardization, processing and combining of data, and ultimately secures a competitive advantage for the country by creating new industries and accelerating the digital transition of key industries.

For the implementation of the Digital New Deal, it is seeking a total budget of 44.8 trillion won for the period between 2020 and 2025. Out of this total, 31.9 trillion won will be designated for stronger integration of DNA, while 0.8 and 2.1 trillion won will be used for digitalization of education infrastructure and fostering the "untact" industry, respectively. In addition, 10 trillion won is allocated to the digitalization of social overhead capital such as building a smart management system, a smart logistics and distribution system, as well as adding digital innovation to urban spaces and industrial complexes. Indeed, the government-driven ICT industry and its intensive and focused financial support are the key pillars of Korea's digital transformation.

TABLE 7. A LIST OF PROJECTS FOR DIGITAL NEW DEAL
(MINISTRY OF ECONOMY AND FINANCE, 2020)

FOCUS AREAS	PROJECTS	EXPECTED BUDGET FOR 2020-2025 (IN TRILLION WON)	# OF JOBS (IN THOUSANDS)
1. Stronger Integration of DNA* throughout the Economy	1) Collecting, disclosing and utilizing data in areas closely related to people's lives	6.4	295
	2) Expanding the integration of 5G and AI into industries	14.8	172
	3) Making a smart government that utilizes 5G and AI	9.7	91
	4) Advancing cyber security	1.0	9
	Sub-total	**31.9**	**567**
2. Digitalization of Education Infrastructure	5) Creating technology-based education infrastructure for grades 1-12	0.3	4
	6) Strengthening the online education system of universities and job training institutions	0.5	5
	Sub-total	**0.8**	**9**
3. Fostering the "Untact" Industry	7) Building smart medical and care infrastructures	0.4	5
	8) Promoting remote working in SMEs	0.7	9
	9) Supporting online activities of microbusinesses	1.0	120
	Sub-total	**2.1**	**134**
4. Digitalization of Social Overhead Capital (SOC)	10) Building a smart management system in four sectors	8.5	124
	11) Adding digital innovation to urban spaces and industrial complexes	1.2	14
	12) Building a smart logistics and distribution system	0.3	55
	Sub-total	**10.0**	**193**
	Total	**44.8**	**903**

*DNA refers to data, network and artificial intelligence (AI), the three innovative industries selected by the Presidential Committee on the Fourth Industrial Revolution in Korea.

3.2.3.

PARTNERSHIP BETWEEN PUBLIC AND PRIVATE

One of the success factors of Korea's informatization policy is that, while retaining a government-led nature, there has been close public-private cooperation in the policy formulation process as well as in the implementation process. In the policy formulation process, civilian experts were involved, accommodating policy demands from the public and industries. In the policy implementation process, the private sector played a more active role, making an active investment in broadband and digital technologies.

In addition to the involvement of the private sector in the policy formulation and implementation process, risks from technology R&D projects and large-scale investment in infrastructures were shared between the private and public sector, creating an initial demand for the ICT industry in the informatization process. For example, the first electronic switching system (ESS) in Korea, which is referred to as TDX, was developed and manufactured by an R&D consortium of government-funded research institutes, academia and private companies, namely KT Corporation, Electronics and Telecommunications Research Institute (ETRI), LG Electronics and Samsung. The development of TDX was the result of cooperation between the public and private sectors as well as between competing firms. In fact, the development of TDX was revolutionary, contributing immensely to the rapid growth of the domestic IT industry by allowing low-cost availability, which would have been very costly if the device had been imported. This eventually led to the advancement of ICT technologies, including the development of software involving hundreds of lines of code and the assembly and production of components unavailable domestically at that time.

Apart from TDX, various innovations were developed and commercialized in public-private partnerships, such as 4M dynamic random access memory (DRAM), a type of random-access semiconductor memory developed by Samsung, LG Electronics, Hyundai and Electronics and Telecommunications Research Institute (ETRI) in 1988, and code-division multiple access (CDMA), a channel access method used by various radio communication technologies that was developed by ETRI in 1996 and commercialized by LG Electronics, Daewoo, Dongyang and Samsung through technology transfer. Furthermore, ETRI, in partnership with Samsung Electronics, LG Electronics, Hyundai Electronics and Trigem Computer, developed a domestic mid-size computer, which was then purchased by the government and deployed to central government agencies. The public-private investments in computers created a win-win situation by allowing the purchase of domestic computers from the Korean private sector and laid the foundation for e-governance in Korea.

Indeed, PPPs played a critical role in the success of Korea's digitalization. The government and the private sector worked together to plan, finance and implement ICT projects, which resulted in the development of critical ICT equipment at a lower cost domestically, a greater investment in network infrastructure, and eventually enabled service delivery to citizens and a great number of jobs to be created in the ICT sector following the Asian Financial Crisis.

A key feature of the Korean public-private partnership in informatization is that the role of the government has been gradually reduced while the role of the private sector has grown. The initial phase of Korea's informatization can be highlighted with strong governmental leadership and the role of the Ministry of Information and Communication (MIC) as the policy "control tower" in the ICT sector. However, as progress was being made, the government-led development approach started to hamper further development of the ICT sector. Since the state was directly involved in the management of the telecommunications sector, which initially succeeded in creating economies of scale, the natural monopolies have resulted in inefficient management and a delay in the introduction of new technologies.

Recognizing such problems, the role of the private sector was gradually emphasized particularly in terms of the proliferation and advancement of ICTs through investment in infrastructure and R&D for new technologies and services. Furthermore, the government encouraged rate competition among existing and new players in the telecommunications services sector that eventually led to a sharp increase in subscribers, operators and revenue. For instance, the government's privatization of Korea Telecom (KT) in 2002 not only helped KT to improve its financial and operating performance in terms of its profitability and efficiency but also contributed to the development of the telecom industry by deregulating entry barriers in telecommunication businesses and stimulating market-based competition. Indeed, the building of a public-private partnership and the gradual shift from the government-led toward the private sector-led model were the key contributors to the sustainable long-term success of the ICT sector.

In addition, Korea's ICT laws have been constantly revised in line with the gradual shift from the government-led toward the private sector-led model and to foster new ICT industries and convergence of services. For example, the Electronic Signature Act was entirely amended in 2020, abolishing the certified electronic signature that needs to be based on a public key certificate and thereby switching the electronic signature framework from government-led to private sector-led system. More recently, the Korean government is pursuing deregulation in new ICT industries to promote the creation of new markets and convergence. This includes the ease of regulations on the mandatory use of authorized certificates for online banking and the introduction of a new alternative means replacing citizens' ID numbers. It also includes revision of the ICT Convergence Act and the Framework Act on Electronic Documents as well as the enactment of the Special Act on Promotion of Information and Communications Technology, Activation of Convergence Thereof, Etc. that aims to foster new ICT industries to keep up with the development and convergence of ICT industries and services.

In line with government support in the form of joint R&D between the public and private sectors and deregulation, the private sector's efforts in making the necessary investments also played a crucial role in rapid development of the ICT industry. R&D expenditure in the ICT industry has been steadily increasing, accounting for more than half of the R&D expenditure of all other industries.

3.2.4.

HUMAN CAPITAL DEVELOPMENT IN ICT

Korea's ICT human resources development history took place in the process of the government's coordination of individuals, educational institutions and companies. The government's long-term investment in human resources has greatly contributed to the promotion of nationwide digital literacy and transformation of non-IT human resources to IT specialists. The government provided IT training not only for government officials but also for every citizen regardless of region, gender, age and profession, to overcome the digital divide. The human resources development program in Korea for ICT was first initiated in 1997 and has evolved throughout the past 20 years to meet the rapidly changing demands of the society and the ICT industry. The initiative can be divided into five phases by what the government had focused on in each period.

ICT Infrastructure Building Period (1997-2000)

This period was the start of Korea's human resources department development, and the main focus was on expanding infrastructure. During this period, the distribution of computers and the internet to every school across the nation was the top priority. This was done so that the education sector could produce ICT-literate human resources. ICT training programs were divided into four categories that each focused on human resources with different backgrounds. Two programs were aimed at human resources in tertiary education in the process of getting a bachelor's degree or above. Another one was aimed at providing specialized training for already existing ICT human resources to further advance their skills. The last program aimed to train potential ICT human resources so that new generations, females, soldiers, the underprivileged and juveniles could get the necessary ICT-related education.

Thirty universities in total were selected and provided funding ranging from 1.5-3 billion won each according to their size. Each university had an evaluation period of four years, and universities whose performance was unsatisfactory were dropped off the project and replaced by lower-ranking universities. ICT education that was relevant to the demands of the industry was provided in select ICT specialized colleges and high schools with a total budget of 20 billion won. To promote more females in the ICT industry, women's colleges were selected for ICT education, while related policies were made to ensure employment of more female labor in the ICT industry. Meanwhile, projects like computer creativity contests were also held in 1999 to discover young ICT talent. Furthermore, computer education for soldiers, females and the disabled was provided, each having a budget of 2 billion won.

ICT HRD Policy of Quantitative Expansion Period (2001-2003)

Big companies like Samsung grew their global market share during this period as the government implemented policies that could sustain this growth. A study in the paper Characteristics, Status Quo, Demand and Supply Forecasts of IT Professionals by the Korea Information Society Development Institute found that there would be a shortage of approximately 1 million ICT professionals by 2006, so the government needed to increase the quota for universities in major ICT fields. However, since the government did not have the authority to adjust the enrollment quota for universities, they provided a financial incentive. The expansion of ICT- related majors led to enrollment quota increasing by approximately 15,000.

The Ministry of Information and Communication initiated the “10 Million Citizens Informatization Education Plan,” which targeted almost all classes of citizens including housewives, prisoners and even farmers. By June 2002, more than 25% of the Korean population received informatization education, which increased the ICT capability of the public.

TABLE 8. CONTENT OF IT EDUCATION FOR 10 MILLION CITIZENS PROJECT (KO AND KANG, 2014)

CLASSIFICATION	PROJECT DETAILS	BUDGET (IN WON)
Support for ICT-skilled, gifted young talent	Host a computer creativity contest to discover gifted young ICT talent; provide further ICT education for young talent	700 million
Informatization education support for the disabled	Provide informatization education for the disabled to promote social participation via the internet and to enhance their ability to adapt to the Information Age	2 billion
Informatization education support for females	Provide informatization education for females to promote the social participation of the female labor force Support special education institutions for women operated by Gifted Scout of Korea and Central Women's Association	2 billion
Informatization education support for soldiers	Provide information and communication education to young soldiers* to equip them with digital knowledge required for modern warfare	2 billion

ICT HRD Policy in Horizontal Linkage Strengthening Period (2004-2007)

The previous attempts at increasing ICT capacity had created a problem. A study done by KRIVET estimated that there would be an oversupply of ICT professionals with a bachelor's degree or lower but a shortage of ICT professionals with a master's degree or higher until 2010. Another problem was that tertiary education focused on theoretical ICT courses, while practical ICT skills were in demand at companies. So, this period was focused on increasing the number of highly trained ICT professionals. In addition, connecting education to business was carried out by Hanium, an E2B site that connects companies to the open public by providing mentoring and re-education of human resources. The Seoul Accord pushed to adjust ICT major curricula in Korea to be adapted to satisfy industry demand.

* Korea's military service is obligatory for all males (2 years for enlisted men and 3 years for officers).

ICT HRD Policy in ICT Professional Skills Deepening Period (2008-2014)

Convergence was the main focus of this period. New ICT strategies set directions to converge advanced ICT industries and traditional industries. School curricula were also aimed to fill the gap between industry needs and actual ICT human resources performance. With the mortgage crisis in 2009 and mobile phone manufacturing companies not quite prepared to deal with the new demand for smartphones with the introduction of the iPhone by Apple in 2010, companies could no longer wait for universities to supply them with the manpower they needed. This led human resources development in ICT to shift from being government oriented to private oriented.

Feedback indicated that graduate programs should be the focus of HR development, since highly skilled human resources were in demand. However, the government chose to push projects aimed at reorganizing undergraduate education curricula. The government also introduced a new ICT internship program, which extended the internship period to strengthen the link between students and companies.

Another big change in human resources development policies was the shift from hardware to software. Previous ICT had mainly been focused on hardware but later expanded to software. ICT convergence has rapidly increased the need for software professionals. Companies during this period would only hire a fraction of the manpower developed by schools due to their lacking practical skills that are useful for business. This was addressed by enhancing the quality of university education and increasing practical business capacity for job applicants.

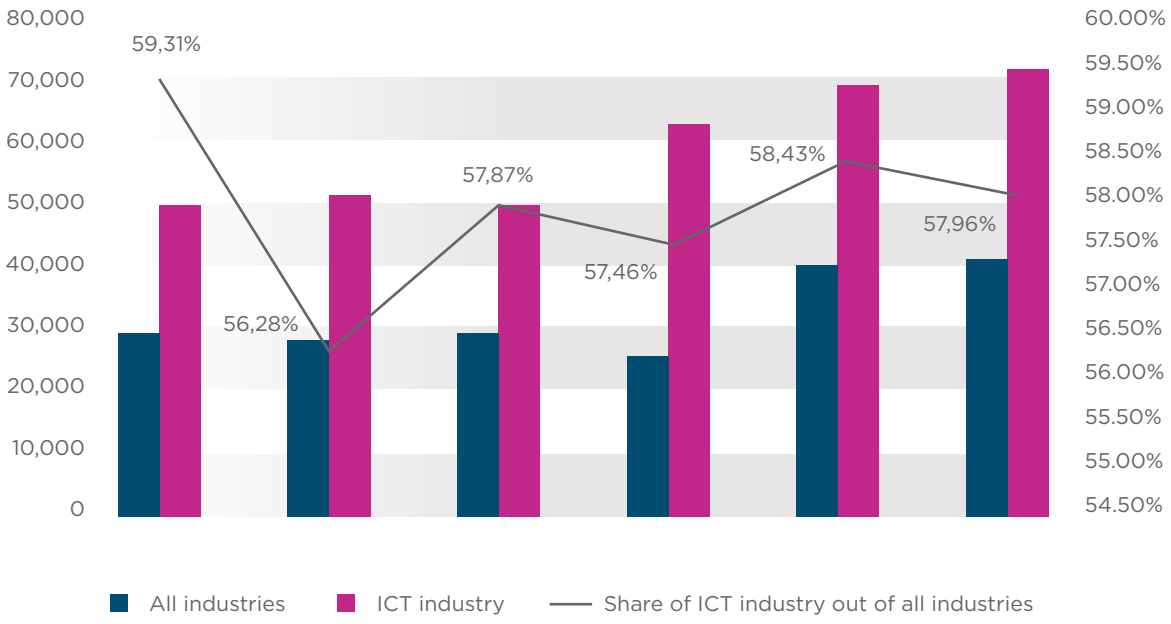
The Korean New Deal Period (2020-)

The Digital New Deal, which was motivated by the COVID-19 pandemic, aims at promoting digital innovation and dynamics in the economy. There are currently 12 overall projects in process, with the goal of investing 18.6 trillion won and creating 900,000 new jobs. This initiative will mainly focus on scaling up investments until 2022 and settling the transformation starting in 2023.

The digitalization of educational infrastructure is aiming to create technology-based education infrastructure for grades 1-12 and strengthening online education systems for universities and job training institutions. High-speed Wi-Fi will be provided to all elementary, middle and high schools, and 200,000 old computers will be replaced with new ones. The education effect of tablet PCs will be tested out in 1,200 schools with the distribution of 240,000 units. Launching online learning platforms is important for schools, universities and training institutions alike. A total of 2,045 lectures that provide education on AI and robotics will be developed and made available for the general public through Korean Massive Open Online Course (K-MOOC) by 2025. A job training system that combines both online and offline courses will be developed on the Smart Training Education Platform.

There will be investment in human resources to fill the digital gap, with the goal of investing 4.4 trillion won to create 180,000 jobs by 2025. Research organizations will be aiming at training 100,000 individuals in AI and software and 20,000 in green engineering. Training on digital integration will be available for 40,000 people in 2021, increasing to 50,000 a year starting in 2022. A curriculum that integrates new technologies will be established in 40 universities for 10,000 students.

FIGURE 12.
R&D INVESTMENT OF THE ICT INDUSTRY (IITP, 2021) (UNIT: BILLION WON)



However, small- and medium-sized enterprises (SMEs) and start-ups often lag behind in digital capacity while R&D activities have traditionally been concentrated in big companies and government-funded research institutes. In recent years, various efforts have been made to reform the R&D ecosystem and put greater emphasis on start-ups and SMEs. These efforts include allocating a greater percentage of R&D funding to SMEs; increasing the ease of SME access to non-debt financing; creating innovation hubs; and providing tax incentives to firms that provide financing to start-ups. For example, 19 Centers for Creative Economy and Innovation (CCEIs) were established throughout Korea, which support R&D in Internet of Things (IoT), biotech, 5G, cloud and fog computing, big data and AI. One of the main functions of the CCEIs is to promote the R&D activities of SMEs and start-ups using the business ideas and technology resources of the cooperating research institutes, universities or conglomerates. The importance attached to the development of SMEs is also highlighted by the establishment of the Ministry of SMEs and Startups in 2017.

Overall, the development of the ICT sector in Korea was first driven by the government and then driven by the private sector, a shift from a monopolistic state-owned market to a competitive market. In addition, the government has played a crucial role in the development of the ICT industry, especially in the early stages of the development.

3.3.

DIGITAL TRANSFORMATION STORIES IN KOREA

In subchapters 3.1 and 3.2, we analyzed the development process of the digital ecosystem, capabilities and strategies in Korea. This section focuses on Korean digital transformation stories on how real-world digital transformation took place and confirms the facts and myths around the concept of digital transformation. In addition, concepts related to digital transformation such as smart factory, digital leadership, edutech, neobank and smart farm are covered in these stories. The following table shows the outline of topics and stories covered in this subchapter.

TABLE 9. TOPICS AND STORIES OF DIGITAL TRANSFORMATION IN KOREA

TOPIC	CASE
Digital transformation is a major challenge for non-digital industries	• A manufacturing company founded in 1968 has taken on digital transformation • A company that exchanged existing brand value for future business model (BM) to achieve strategic innovation and digital transformation
Leadership can trigger digital transformation in a top-down manner	• Corporate leadership can cause digital transformation • The National Digital Transformation project to spread digital across sectors
Individuals can be the leaders in digital transformation	• Digital transformation led by Smart Citizen Lab • A Korean teacher leads digital transformation of global classrooms
Digital transformation can be useful competitiveness for startups	• A new company opens up new digital financial market having high regulation uncertainty • Armed with digital to compete with giants
Digital technology can go beyond sectors and create new agricultural businesses	• An agricultural business without farmland • Telecommunications company that digitizes cultivation methods and seeks scientific farming using data

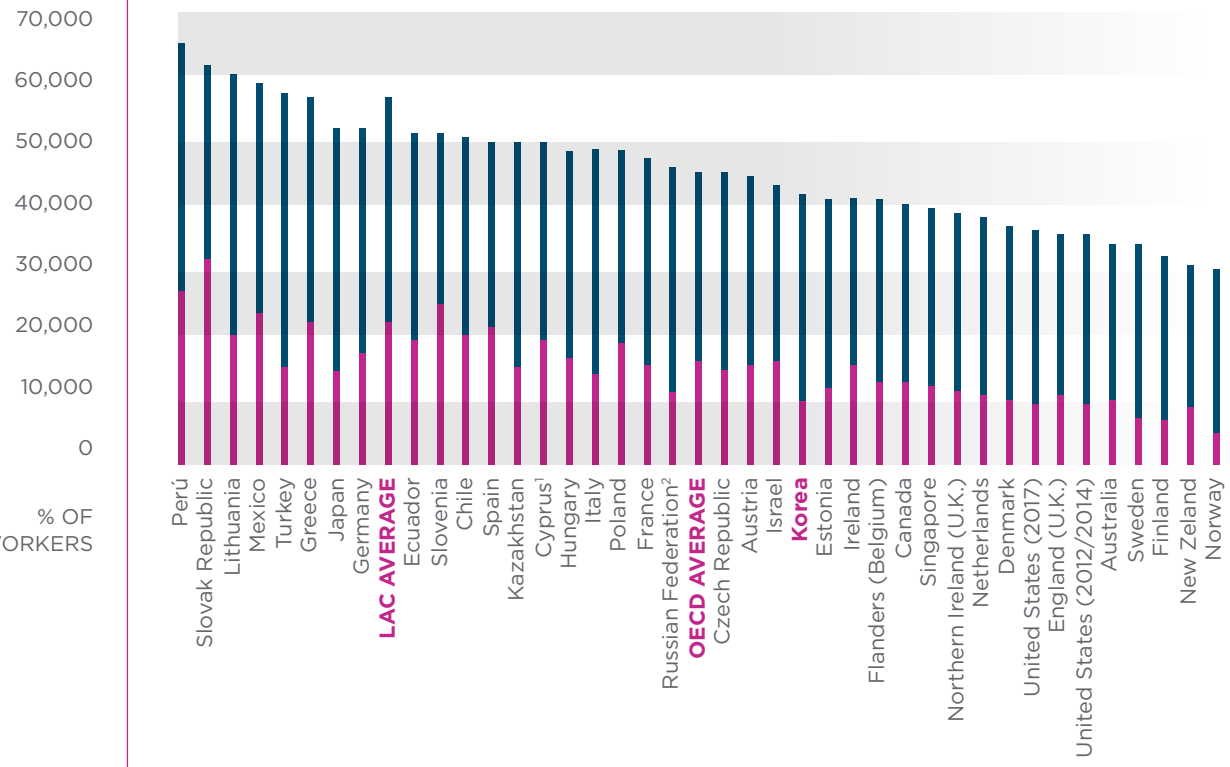

H2O
NPK
+156%
WATER

DIGITAL TRANSFORMATION IS A MAJOR CHALLENGE FOR NON-DIGITAL INDUSTRIES

- Digital transformation at a manufacturing company founded in 1968
- A company introduces a smart factory platform to increase brand value

59% of jobs in LAC are likely to be automated

(OECD Latin American Economic Outlook, 2020)



Latin American Economic Outlook 2020, OECD, Economic Commission for Latin America and the Caribbean, CAF Development Bank of Latin America and European Commission, 2021.

Digital transformation at a manufacturing company founded in 1968

1. DX Type

Digital transformation of non-digital industry

2. Company/Organization/Individual

POSCO – **Conglomerate, Annual Revenue US $50 billion (2020), Est. 1968**

3. Sector

Steel manufacturing

4. Story

POSCO is a world-class steel manufacturer selected as a "lighthouse factory" by the World Economic Forum because it has applied artificial intelligence to the manufacturing process and established a cooperation ecosystem with universities, small and medium-sized enterprises, and startups. The reason POSCO started to implement smart factories was a sense of crisis. POSCO has long been renowned as the No. 1 steel company in Korea and one of the top 10 steelmakers in global steel production, but the manufacturing paradigm was changing rapidly. Leading smart factory businesses like GE and Siemens have been at the forefront of introducing smart factories and demonstrating their potential.

Since the 2000s, POSCO has steadily paved its own way to digitize the production process. In 2016, AI furnace was installed at the Pohang Steel Mill. Process variables that seemed unclear began to be seen as accurate data after the transformation. In the past, workers had to measure the amount of fuel and raw materials and the heat of the furnace, but cameras and sensors installed in the facility replaced those tasks with reliable data.

POSCO has also helped other players in the ecosystem navigate the digital paradigm shift. It has engaged in digital talent training projects supported by the Ministry of Strategy and Finance. This project involved conducting an AI Big Data course with an annual participation of 300 people. Through these talent training projects, POSCO contributes to the social demand for new technologies and trains potential workers. It has also been supporting the smartization of small and medium-sized businesses' factories through a "win-win smart factory support project" with the Ministry of SMEs and Startups.

1968
Founding

2016
Digitization of furnace in Pohang

2017
Smartization declaration

2019
Win-win smart factory project supported by Ministry of SMEs and Startups

2021
Digital talent training projects supported by Ministry of Strategy and Finance

5. Digital transformation

• AI Blast Furnace

POSCO's AI blast furnace predicts air permeability, combustibility, the temperature of molten iron, the amount of skull and molten iron production, and controls operating conditions. It studies live-collected data and assesses the quality of fuel, raw materials, and furnace conditions. Then, it predicts the operation result and controls the furnace operating conditions to yield the best combination with minimum error.

• PosFrame

PosFrame is a smart factory platform developed by POSCO that collects, organizes and stores large amounts of data generated during the steel production process and uses it to create quality predictions and facility failure models using high-end data analysis technology and AI. PosFrame applied drones to inventory analysis of raw materials that were directly observed and managed by humans. Pohang Steel Mill and Gwangyang Steel Mill have a total of 2.73 square kilometers of raw material yards. Previously, it took an hour and 20 minutes to measure inventory and four hours to analyze inventory. However, with PosFrame inventory management drones, the raw material yard inventory measurement time was reduced to 20 minutes. Plus, using its own data processing algorithm, inventory analysis time was reduced to one hour.

• Transforming together within the ecosystem

POSCO is not only applying new technologies to its businesses but also helping other players in the ecosystem. First, it is working on a technology-sharing project with the Ministry of Trade, Industry, and Energy. It has been working on the project since 2017 and plans to share 588 technologies with related SMEs free of charge by 2021. Second, it is working on a project with the Ministry of SMEs and Startups to support the construction of smart factories. The project will support about 500 companies from 2019 to 2023. Third, it has trained digital talent in society. It has been operating AI Big Data Academy with 200 employees per year since 2019. About 400 students have graduated from the academy so far, and some of them have been employed by POSCO Group. In 2021, the number of students increased to about 300 annually with support from the Ministry of Strategy and Finance.

6. Reward

• Increased Efficiency

Saved US $224 million since 2016 and produced an additional 250 tons of molten metal per day.

• Promoted Brand Image

Selected as the "lighthouse factory" of the Davos Forum in 2020.

• Increased Precision

99.9% accuracy of production design.

A company introduces a smart factory platform to increase brand value

LS ELECTRIC

1. **DX Type**

Digital transformation of non-digital industry from electric power equipment manufacturing to smart energy solutions with automation software

2. **Company/Organization/Individual**

LS Electric – **Conglomerate, Annual Revenue US $2.08 billion (2020), Est. 1974**

3. **Sector**

Past: Electric Power Equipment, Power Distribution
Present: Industry Automation, Smart Energy Solutions

4. **Story**

LS Electric is Korea's leading electric device business, which maintains the world's highest quality and technology in the stable power and automation business. This company aims to lead future energy technology development and dominate global markets. Although it has maintained the name LS San- jeon (Industrial Electricity) for the past 33 years, it has changed it to LS Electric despite its high brand value to transition its long-term business model to smart energy solutions that satisfy the keywords global and digital convergence. LS Electric has entered a variety of growing industries, ranging from ESS to automotive electronic components, based on its unrivaled competitive advantage in the low and medium-pressure power equipment and power infrastructure markets.

LS Electric's power devices and automation projects are closely related to construction, new investment by companies, and SOC investment by the Korean government. It benefited from the Korean government's policy to expand renewable energy in 2018, the governmental investment in renewable energy in 2019, and the establishment of infrastructure in the digital and green sectors by the Korean New Deal in 2021.

LS Electric has established a customized design system that combines IoT and automation technology to produce products that meet clients' needs and flexibly design the production process itself using AI. Currently, it collects data from all sections and uses it for production management. In particular, LS Electric's camera sensor automatically monitors 17 items and 53 points, reducing the defect rate significantly. To accelerate the development of Korea's smart factory technology, it also opened its smart factory technology to small and medium-sized enterprises.

1974
Founding

2011
Establishes smart factory with 20 billion won investment

2015
Completes Smart Factory construction and successful FEMS commercialization

2018
Implementation of CAE platform

2018
Policy to expand renewable energy

2019
Creates Kora's first open smart factory platform, Tech Square

2019
Governmental investment in renewable energy

2020
Changes name from LS Sanjeon to LS Electric and is recognized as a leader in power solutions and automation solutions

2021
Korean New Deal - Digital New Deal, Green New Deal

5. Digital Transformation

• CAE Platform

LS Electric has been striving to innovate the R&D process and implement digitalization by introducing a frontloading development system since 2015. Front loading is a crucial idea in digital engineering that reduces the time and cost and increases the quality of product creation by anticipating problems in R&D and production, as well as increasing a company's competitiveness. LS Electric combined analysis and product development through a CAE platform that connects designers with production engineers, resulting in a significantly shorter product development cycle, lower product development costs, and increased performance and quality. Big data analysis employing interpretative data gathered through the CAE platform is also predicted to be built as a virtuous cycle process fit for the Fourth Industrial Revolution era, leading to future inspiration for new product planning.

• Tech Square

While the market is expanding rapidly in line with the government's policy to create 30,000 smart factories, LS Electric is expanding the establishment of smart factories by various manufacturing companies through the development of Tech Square, Korea's first smart factory ecosystem platform. In addition, it is leading future production lines by using the Smart Factory platform and establishing a 100% automated system. It has established a customized design system that combines IoT technology and automation technology to produce products that meet customers' needs. It flexibly designs the production process itself by utilizing a demand prediction system based on AI estimation, collects data from all sections, and uses it for production management.

• Electric + Vision+ ICT

LS Electric's sensors can automatically monitor 17 items and 53 points, and acquire and analyze images of products through cameras, optics and lighting installed on production lines. It was adopted as part of efforts to change from device-centric to solution platform-centric processes, such as convergence of manufacturing technology and ICT technology, IoT, and smart transmission/distribution network technology.

• Open Innovation

It quickly identified the global trend that the energy market is evolving into a venue for changes and innovations based on digital transformation and smart connectivity. To accelerate the development of Korea's smart factory technology, the company made its smart system available to SMEs.

6. Reward

- **Change in Business Structure:**
Transformed from a simple equipment producer to a solution provider of innovative technologies and digital transformation.

- **Industrial automation business**
Utilized technologies and equipment that promote energy efficiency when planning and operating diverse power and signal networks, and maximized efficiency by controlling motors at production facilities. Industrial PLCs, inverter SERVO, and HMI are among the company's most focused products.

- **Smart Energy Industry**
Promoted green businesses such as smart grid, solar energy, HVDC, ultra-high pressure direct current transmission, ESS, and energy storage as key future growth engines.

- **Promoted Brand Image:** Selected as one of the top 100 innovative companies in the world for nine consecutive years by Clarivate Analytics.

- **Global Growth:** Received the highest global ratings in patent success rate in intellectual property (IP), application rate in four foreign regions, and fine use.

FOCUS

SMART FACTORY

• **The level of production in Latin American industry mostly depends on traditional factors such as the exploitation of natural resources for their future commercialization (ILO, 2020).** This is the case in Argentina, where 34% of exports correspond to agricultural products, 30.07% to primary products, 29.3% to industrial manufacturing, and 6% to fuel and energy (Camara Argentina de Comercio y Servicios, 2020).

• Similarly, Korea's principal businesses relied on agriculture until the 1960s, but due to the Korean government's industrialization and related policies, the agricultural population decreased 36% between 1970 and 2000. Heavy chemical, manufacturing and export-oriented industrial strategies were implemented during this time, and large expenditures in the high-tech industry are currently being made.

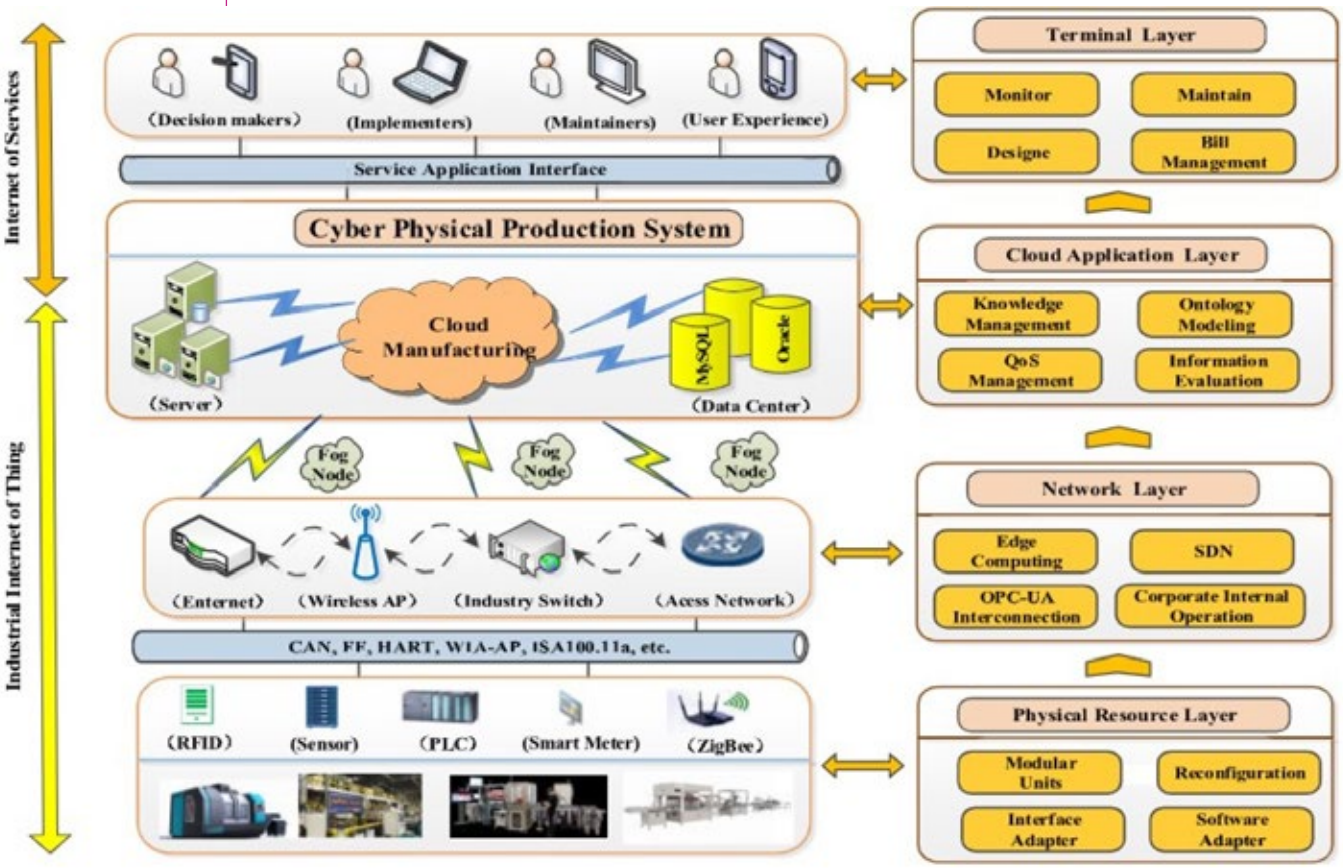
• **In this context, one of the Argentinian government's strategies might be similar.** The Argentinian government aims to promote production in agriculture, livestock and fisheries, energy, mining and oil by introducing policies that encourage digital technology adoption (Labor, 2020). However, establishing a feasible strategy requires a workforce with advanced digital technology skills, which is a common concern globally for existing non-digital industries. Unfortunately, in Argentina, only 16% of its inhabitants have the skills and knowledge to face the challenges of digital transformation, forcing Argentinian industries that were not "born digital" to adapt to scenarios in which technology could be part of basic production activities (CIPPEC, 2020).

• **This is where Korean smart factory technology may be applied.** The smart factory is an intelligent production plant that improves productivity, quality and customer satisfaction by applying ICT combined with digital automation solutions in the production process. Until now, process automation technology has been implemented individually for each process, making it difficult to manage the entire process organically.

• However, thanks to ICT technology, all facilities and devices are connected by wireless communication, allowing data to be freely linked between processes, thereby creating a more organic, integrated and optimal production environment. Because of its high cost efficiency outside of management, smart factories no longer have to rely on expensive labor and are free from the uncertainty of inventory caused by mass production. In addition, automation has added flexibility to the production line, enabling immediate production of personalized products at reasonable prices. Smart factory changed the existing centralized production system and enabled the manufacturing industry to decentralize and liberalize production.

• **In Latin America, companies that integrate new knowledge and technology into their production processes can also be found utilizing the benefits of digital innovation.** Sinteplast (a company founded in 1958 that currently leads the Argentinian paint products market) has incorporated technological elements mainly in its inventory management and production processes, enabling a considerable increase in its levels of efficiency and inventory management. As a result, the delivery time has been reduced and the service quality has improved. (Camara Argentina de Comercio y Servicios, 2020).

• **Furthermore, it is suggested that smart factories are needed to upgrade manufacturing in digital factories.** Beyond simply adding technical elements to the process, implementing a smart factory will lead to a revolution in traditional industries. This should be assumed to be an essential element in the Fourth Industrial Revolution Era, addressing the main issues of the methodology and core technologies implementing smart factories, and potential solutions to them. The architecture of the smart factory is divided into four layers: physical resource, network, data application, and terminal, and securing technology for each layer of implementation will be an important issue.



Chen, B., Wan, J., Shu, L., Li, P., Mukherjee, M., & Yin, B. (2017). Smart factory of industry 4.0: Key technologies, application case, and challenges. Ieee Access, 6, 6505-6519.

- **Physical Resource Layer**

Physical equipment must support real-time information acquisition. Communication devices must be able to transmit information at high speeds. To satisfy the requirements of IoT, workplaces must be equipped to allow for quick reconstruction and adaptation, and the intelligence of the underlying technology must be strengthened.

- **Network Layer**

Industrial IoT must support new protocols and new data formats with high flexibility and scalability (industrial wireless sensor network (IWSN). Relevant techniques should be introduced to ensure communication between quality of service (QoS) and devices (D2D) in the network.

- **Data Application Layer**

Cloud platforms must be able to analyze semantics of various data. In particular, ontologies being adopted in the modeling of smart factories can provide self-organization, self-learning and self-adaptation. Data analysis can provide scientific evidence for decision making, and data mining can be used to ensure design optimization and active maintenance.

- **Terminal Layer**

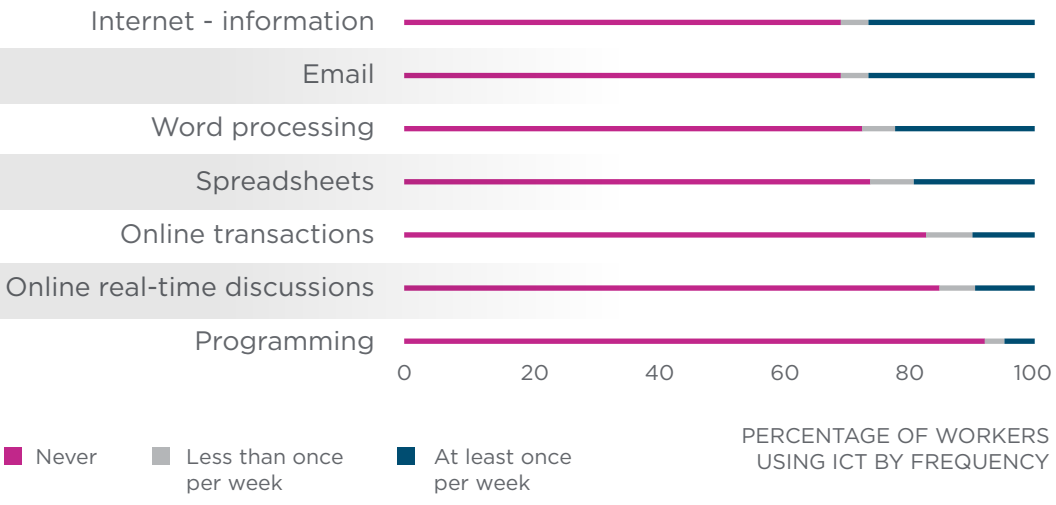
This layer supports the interaction between the system and users through the service application. It provides monitoring, maintenance and operating systems.

LEADERSHIP CAN TRIGGER DIGITAL TRANSFORMATION IN A TOP-DOWN MANNER

- Corporate leadership can cause digital transformation
- National Digital Transformation project promotes digital tech across sectors

More than 60% of workers in LAC don't use ICT at work

(OECD, Latin American Economic Outlook 2020)



Latin American Economic Outlook 2020, OECD, Economic Commission for Latin America and the Caribbean, CAF Development Bank of Latin America and European Commission, 2021.

Corporate leadership can cause digital transformation

1. DX Type

Digital transformation driven by corporate leadership

2. Company/Organization/Individual

Executives of LG Group – **Conglomerate, Annual Revenue US $1.5 billion, Est. 1947**

3. Sector

Electronics, Chemistry and Telecommunications

4. Story

LG Group is one of the major Korean companies that accomplished the miracle of the Han River in 1947. LG Group has businesses in electronics, chemicals, and telecommunications services and has affiliates such as LG Electronics, LG Chem, and LG Uplus. Since LG is well known as a global company that sells high-tech digital products, applying digital transformation to business sites can be taken for granted.

But the reality was different. LG had an AI research organization that developed technologies that would be the basis of digital transformation, and each of the affiliates had an internal organization dedicated to DX. In other words, LG Group had an environment where digital transformation could be carried out. Despite this, it was still difficult to transit old working processes. The digital transition began when leaders of each affiliate stepped up.

1947
Lucky Chemical Industry is founded (former name of current LG Chem

1958
Goldstar is founded (which (former name of current LG Electronics)

1996
LG Telecom is founded, (former name of current LG Uplus)

2012
Smart Business Center is founded (former name of current Digital Transformation TechnologyCenter)

2018
AI propulsion team consisting of 10 experts is founded

2020
LG AI Research is founded

5. Digital transformation

- **Digital transformation-friendly leadership**

It is a misconception that a company such as LG, with huge capital to develop digital transformation technology, would find it easier to apply digital transformation to its business. Even though LG is deeply involved in the digital industry in business sectors such as electronics, telecommunications and chemicals, it was difficult to implement digital transformation techniques at the business sites. Although the AI promotion team recommended AI technology to the Digital Transition Business Council, LG affiliates did not apply the new technology to their work. Application of digital transformation began only when LG's executives decided to address the challenges faced by affiliates and requested that the AI promotion team develop solutions for them. The first requests started with AI solutions to discover anticancer and immune candidate materials, predict battery capacity and life expectancy, analyze patent literature, and detect and resolve communication network abnormalities.

• **Creating an organization for promoting digital transformation**

The digital transformation-friendly leadership led to the creation of professional organizations that would lead digital transformation for the entire group. The old Cloud Center that promoted cloud usage in the affiliates was reorganized to a Digital Transformation Technology Center that promotes related next-generation businesses such as big data, service platforms, and LG ThinkQ apps. LG ThinQ is an artificial intelligence software and integrated control platform that is applied to various LG Electronics' home appliances. LG AI Research, which was established in 2020, is researching and developing artificial intelligence technologies and developing solutions that each affiliate needs. Also, a DX organization was established for each affiliate to communicate with LG AI Research in the process of developing necessary solutions.

With the creation of a digital transformation promotion organization, the demand and supply system for digital transformation within LG Group was completed. Affiliates now acknowledge the value of digital transformation and can seek advice on management issues for which they want to apply digital transformation. Digital transformation has enabled LG Group to develop solutions by receiving data from the affiliates related to various problems they need to solve.

6. Reward

• Increased management efficiency: LG Uplus, one of LG's affiliates, saved about 110,000 hours in 2020 by digitizing its handwritten work and introducing robot automation. LG Household & Health Care's "Rpartjang" processes inputs and inquiries of certain computer systems such as Excel tasks and order processing. As of February 2020, Rpartjang had 249 tasks in sales, accounting and marketing departments and recorded a 95% success rate.

• Improved productivity: Through the smart factory platform FACTOVA developed by LG CNS, the prototype production period was shortened by about two months, and the defect determination accuracy was 99.7%.

National Digital Transformation project promotes digital tech across sectors

과학기술정보통신부
Ministry of Science and ICT

1. **DX Type**

Digital transformation driven by public leadership

2. **Company/Organization/Individual**

• Ministry of Science and ICT (MSIT) – **Central administrative agency, Est. 1948**

• National Information Agency (NIA) – **Quasi-governmental agencies under MSIT, Est. 1987**

3. **Sector**

Government, Public Health, Agriculture

4. **Story**

The Ministry of Science and ICT (MSIT) is a central administrative agency originally established in 1948 in South Korea to oversee general management, coordination, evaluation, science and technology research, development, production, utilization, national information planning, information protection and information culture since 1948. National Information Agency (NIA) is a quasi-governmental organization established in 1987 under the MSIT that aims to develop policies related to informatization promotion, create an information culture, and close the digital gap.

In 2018, MSIT and NIA started a new public service digital transformation project, the National Digital Transformation Project. Through the project they led and stimulated the change of public service infrastructure. The project supports the public sector's digital system demand and private companies that can supply these systems through the project.

1948
Establishment of Korean government ministry of postsand communications which preceded the current Ministry of Science and ICT (MSIT)

1967
Establishment of the Ministry of Science and Technology, which preceded the current MSIT

1987
Establishment of National Computerization Agency, which is former name of National Information Agency (NIA)

1988
NIA operates computer classes for rural province

2013
NIA opens Public Cloud Support Center

2018
National Digital Transformation

2019
NIA builds a government-wide data platform

5. Digital Transformation

• Electronic Medical Records (EMR) standard development

The Ministry of Health and Welfare developed a standard framework for electronic medical records (EMR) to share individually established EMR by medical institutions and medical companies nationwide and established a web platform for private provision with support of the National Digital Transformation Project in 2019. By May 2021, about 478 hospitals participated in the EMR certification standard. The Ministry of Health and Welfare aims for 3,000 hospitals to participate in this standard in the future.

• **Blockchain-based eco-friendly agricultural product distribution platform**
Jeollanam-do has more than half of Korea's eco-friendly certified farming land. With the support of the National Digital Transformation Project, Jeollanam-do's local government developed an eco-friendly agricultural product distribution platform that applies blockchain technology to the entire process of production, processing, distribution and consumption of eco-friendly agricultural products. The biggest change this newly developed agricultural platform brings is increased reliability following agricultural history tracking. Jeollanam-do's eco-friendly agricultural products, which will be sold through school meals and online markets, can be tracked within this platform. Furthermore, it is predicted that the efficiency of school meal service will be greatly improved by replacing various paper documents generated during the distribution process with the newly established information system.

6. Reward

• **Improving the quality of medical system and digital health**
The EMR standard certification is expected to enhance patient safety and continuity of care, and encourages medical product companies to develop EMR standard products using standard terminology, a standard development guide, the Korean CDA template, and open source.

• **Improved reliability**
Digitally recorded information on eco-friendly agricultural products can be reviewed by all participants including producers, sellers and consumers.

FOCUS

DIGITAL LEADERSHIP

• Digital transformation success factors are not limited to ample funding and advanced technology. According to Forbes, 74% of companies that start a digital transformation process fail (Forbes, 2018). And lack of leadership is the main reason for the failure (Leopold, Ratcheva, & Zahidi, 2018). In other words, digital leadership is one of the key drivers of digital transformation success.

• But what is the difference between digital leadership and traditional leadership? According to an MIT Sloan Management Review survey, with 3,300 respondents including business executives from various industries, leaders, and people in academia, digital leadership is characterized by a transparent vision, forward-looking perspective, digital literacy and open-mindedness (MIT Sloan Management Review, 2019).

• A digital leader is not just a technician with a deep understanding of digital technology. According to Jeanne Ross, co-author of the book Designed for Digital (2019) and principal research scientist of MIT's Center for Information Systems Research, only people with senior management responsibility can change the design of an organization. According to Ross, an ideal digital leader is not the smartest person, nor is it a hierarchical person. Good digital leadership is the ability to empower smart people who can understand and define what modern consumers want. Ross said, “Leaders should stop trying to be the smartest people in this room and try to be the ones who can help us come up with the best ideas in this room.” (MIT Sloan Management Review, 2019)

• An example of digital leadership can also be found in Chile. Falabella is a Chilean company founded in 1889 and dedicated to the commercialization of products under the department store model. The leaders of the organization have been transforming their business strategies; in 2018 the company established its position as one of the e-commerce leaders in the region, incorporating virtual assistance and financial services options in its unified service platform to improve the customer experience.

• As a result of the simplification of processes, the number of customers accessing the platform through its mobile application grew 96.5% compared to the previous year. In fact, 3.3 million interactions with its virtual assistant were registered and resulted in a 30% increase in digital sales and more than 21 million digital transfers (Falabella, 2018). Based on this momentum, the organization plans to invest around US $443 million in expanding its technology and logistics capabilities to support its rapid growth in online sales and increase its operational efficiency.

INDIVIDUALS CAN BE THE LEADERS IN DIGITAL TRANSFORMATION

- Digital transformation led by Smart Citizen Lab
- A former teacher leads digital transformation of global classrooms

"New technologies are bringing many opportunities for better social, political and economic inclusion. To make the most of this new context, people need to be resilient and mobile and adapt to the new demands of a digital world at home, work and school."

(OECD, Latin American Economic Outlook 2020)

Digital transformation led by Smart Citizen Lab

Seoul Digital Foundation

1. DX Type

Bottom-up digital transformation system for improving social inclusion

2. Company/Organization/Individual

- Seoul Digital Foundation (SDF) **- Seoul Metropolitan Government-funded agency, Est. 2016**
- Citizens

3. Sector

Public service

4. Story

The Seoul Digital Foundation (SDF) is an organization affiliated with the Seoul Metropolitan Government established in 2016 to make Seoul a global, digitally enabled capital. It is in charge of implementing big data and AI-based administration, supporting innovative growth in work-from-home societies and businesses, and narrowing digital gaps.

In 2018, the SDF launched the Smart Citizen Lab project with citizens to select and solve digital transformation challenges. Citizens contributed to urban problem-solving ideas and related research and development activities.

2016
Establishment of Seoul Digital Foundation (SDF)

2018
Launches 2018 Digital Citizen Lab, which became Smart Citizen Lab

2019
2019 Smart Citizen Lab

2020
2020 Smart Citizen Lab

5. Digital Transformation

• Establishing a citizen-centered digital solution development process that solves urban problems

Since 2018, the Digital Citizen Lab, now called the Smart Citizen Lab, established a citizen-led research, development and activity support system in which a large number of citizens directly solved problems, breaking away from dependence on a small number of experts. All administrative procedures, such as community recruitment, management and subsidy distribution, were directly operated by SDF, but each citizen community had autonomy to manage activities, including the method of promoting the subsidy.

• A total of 51 digital solutions were suggested by citizens over three years

Six citizen teams in 2018, 25 in 2019, and 20 in 2020 were selected to propose digital solutions that solve Korea's urban problems across various fields. The solutions include an application in which someone from the younger generation responds when a senior asks a question, an application that translates loan terminology from Korean to English, an application that links public transportation and car-sharing services, an educational application that teaches users how to use a popular kiosk, etc.

6. Reward

• Direct approach to urban problems and suggesting solutions: A total of 51 urban problems were defined by citizens, who developed the digital solutions themselves.

• Organizational recognition: 2019 Public-Private Cooperation Vitalization Commendation Award (Project Manager), presented by the Seoul Metropolitan Government; 2019 Public Participation Best Practice Selection Organization (Seoul Digital Foundation), awarded by the Ministry of Public Administration and Security; 2020 Seoul Creativity Award Suggestion Execution Segment (Citizen Proposal) Grand Prize, awarded by the Seoul Metropolitan Government.

A former teacher leads digital transformation of global classrooms

CLASSTING

1. DX Type

Digital transformation mainly led by personal motivation

2. Company/Organization/Individual

- A former elementary school teacher, Cho Hyun-gu, who became CEO of Classting – **SMEs, Annual Revenue N/A, Est. 2012**
- Korea Communications Commission

3. Sector

Education

4. Story

Classting's CEO, Cho Hyun-gu, was an elementary school teacher in Korea. In 2012 he entered the K Global Startup Contest hosted by the Korea Communications Commission, to earn server fees for an application to communicate with his students. That was the beginning of Classting, which is being used in 510,000 classes worldwide as of 2021.

2012
Cho Hyun-gu's Classting receives a Korea Communications Commission Global K-Startup 2012 excellence award

Launches educational communication service, Classting

2017
Classting elected as a global top 10 edutech startup by Education Technology Insight

2018
Launches Classting AI, a machine learning-based individualized education service

2021
As of March 2021, the number of global users exceeds 7.15 million

5. Digital Transformation

- **Digital classroom**

Classting has developed a solution that allows the traditional learning process to be conducted online. Teachers can create Classting digital classrooms to post announcements, share learning materials, teach, give assignments, and manage students.

- **AI tutor**

Classting also has developed an artificial intelligence tutor that analyzes a student's learning results with exercises in the Classting digital classroom and recommends appropriate supplementary learning.

6. Reward

- **Global recognition**

World Economic Forum selected Classting's CEO Cho Hyun-gu as a 2020 Young Global Leader.

- **Explosive growth of global users**

The application originally developed for the CEO's own class has 7.15 million global users. Classting is used in 20,000 schools and 510,000 classes worldwide.

FOCUS

EDUTECH

• **Edutech, a combination of education and technology, uses new educational services that improve educational experience through comprehensive innovative technologies including AI, digital, AR, VR and blockchain.** It is also understood as concepts such as e-learning, which emphasizes the use of online education technologies, and smart learning, which focuses on the use of smart hardware learning tools (SPRi, 2020). In addition, the importance of edutech has grown since the coronavirus outbreak. This is because countries have implemented social distancing policies to reduce the risk of disease transmission, which makes it imperative to implement remote learning.

• An Edutech service, developed by companies such as Classting, is a digital learning management platform that enhances various learning activities typically done in traditional classrooms. Communicating with students, giving lectures and assignments, and taking tests take place within this digital learning space. One of the biggest differences from traditional classes is that all data can be collected. All educational activities within this digital platform produce data, which can be utilized to improve the training process.

• The global edutech market is expected to grow from US $153 billion in 2018 to US $342 billion in 2025. This accounts for a relatively small segment, given the fact that the overall education market is worth $6.5 trillion (SPRi, 2020). In other words, the education market is one of the places where digital transformation is slow and has great potential for further development.

• In Ecuador, there are 12,264 public institutions of traditional education, of which 4,488 have internet access, benefiting only 13% of students in rural areas (Ayala et al., 2020). These statistics show us that there is a huge gap in online access, making us think that technological inclusion is not for everyone.

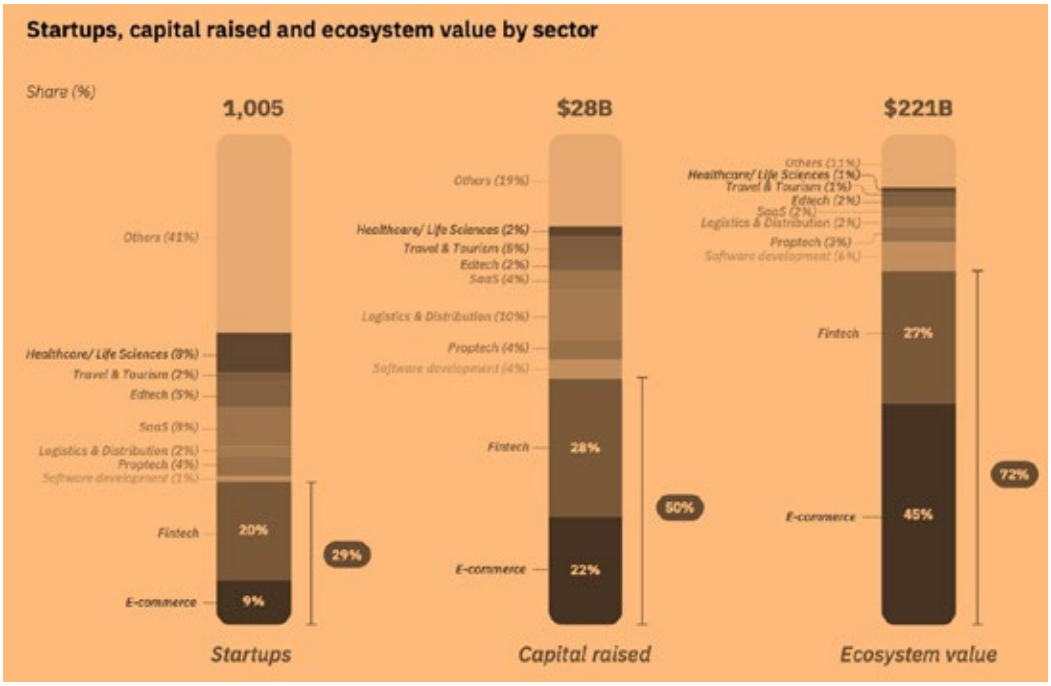
• One example from Ecuador shows how to transform society facing this challenge. Telecommunications company Telefónica Ecuador launched its “Yachacuna” program, which provides support to teachers to strengthen teaching processes based on the development of technology-savvy skills. The program's components include the provision of free educational services and connectivity for teachers and students in the most vulnerable areas. The objective of this initiative is to create more connectivity to help improve education and ultimately the quality of life in these underserved areas (Telefonica Ecuador, 2020).

DIGITAL TRANSFORMATION CAN PROVIDE A COMPETITIVE ADVANTAGE FOR STARTUPS

- A new company opens up the online-only banking overcoming regulatory uncertainty
- E-commerce company armed with digital tech competes with giants

Fintech and e-commerce sectors are dominating the LAC startup ecosystem

(Technolatinas 2021, 2021)



Technolatinas 2021: the LAC startup ecosystem comes of age, Ignacio Peña, IDB LAB and Surfing Tsunamis, 2021.

E-commerce company armed with digital tech competes with giants

1. DX Type

Digital transformation to win a tight competition

2. Company/Organization/Individual

Market Kurly – **SMEs, Annual Revenue US $826 million, Est. 2014**

3. Sector

E-commerce, Food Distribution

4. Story

Market Curly is a food specialty e-commerce company that started in 2014 and has 7 million members as of 2021. Considering that Market Kurly operates services only in Korea, and the population of Korea is about 51 million, this number of subscribers is a remarkable achievement. Around 2014, when Market Kurly appeared, SSG E-Mart, Lotte Mart, and Homeplus, traditional conglomerates based on large offline marts, were also increasing their market share in the online food distribution market. In addition, Naver, Korea's largest internet portal company, launched a service called Store Farm that allows retailers to create their own sales pages. Comprehensive e-commerce companies based on mobile shopping apps such as Coupang, WeMakePrice, and Timon were also aggressively competing for distribution share.

In this online distribution competitive vortex, the strategy chosen by Market Kurly was a new service that created new customer value based on data. Market Kurly achieved this growth by introducing a special service called Saetbyeol Delivery in 2015. This delivery service works on a very simple idea: delivering ordered food by the very next morning. The difference between Market Kurly, which launched such a simple and unconventional service, and existing companies that did not do so, lies in their belief in the effects of data-driven management.

2020
Attracts $150 million through Seoul Metropolitan Government's foreign investment promotion organization Invest Seoul Center

2014
Market Kurly is founded (The Farmers Corporation)

2015
Launches early morning Saetbyeol Delivery

2019
Elected as a pre-unicorn by the Ministry of SMEs and Startups

2021
Number of cumulative members exceeds 7 million

5. Digital transformation

• Data-driven decision making

Market Kurly developed and utilized a data collection and analysis system, Daemungee, which enables more efficient fresh food management. Real-time order status, inventory and sales are shared with all employees every 30 minutes. Based on the collected information, it decides what time to discount, how much to order from the supplier, and how many part-time workers to hire.

• Supporting a challenging and high utility service

To compete with larger retailers Market Kurly launched its iconic service called Saetbyeol Delivery, which delivers items before 7 a.m. the next day, even if order was placed at night. This special service is possible because they predict the order using a data system to accurately predict upcoming future consumer orders and sustain the special service.

• Applying a blockchain-based payment system in partnership with other companies

Market Kurly has adopted a payment service based on a blockchain called CHAI, through partnership with CHAI Corporation, which is an easy payment service company. One of the advantages of a blockchain-based payment system is that it is faster to settle accounts. The existing payment system delivers the payment made by the buyer to the seller through an intermediate company such as an electronic payment agency. A blockchain-based payment system allows the payment made by the buyer to be delivered directly to the seller.

6. Reward

- **Reduced disposal rate**

Fresh food disposal rate in the company was lowered to less than 1%. General hypermarkets' rates are 2-3%.

- **Increased repurchase rate**

Repurchase rate of the service has reached about 60%, while the online shopping industry average is about 30%.

A new company opens up the online-only banking overcoming regulatory uncertainty

1. **DX Type**

Digital transformation overcoming regulatory uncertainty

2. **Company/Organization/Individual**

- KakaoBank – **Conglomerate, Annual Revenue US $697 million, Est. 2016**

3. **Sector**

Online-only bank

4. **Story**

When an opportunity for a banking license, which had been tightly closed since 1992, opened up, KakaoBank jumped at the challenge. KakaoBank, a domestic internet bank launched in July 2017, was initially deeply concerned, but two years later, it is recognized as an icon of innovation for financial consumers and as the biggest competitor to traditional banks in the financial technology (fintech) era. KakaoBank surpassed 10 million customers on July 12, 2019, two years after it started. As of June 2020, KakaoBank customers account for 44.3% of the nation's economically active population, with 22.3 trillion won in receipts and 17.3 trillion won in loans.

By successfully using the popular characters from Kakao Friends, a cheerful lifestyle brand in Korea, with its consumers, KakaoBank caught the attention of the younger generation. The company's approach to mobile banking services is to attract mobile-savvy people. Today's young customers, who are familiar with mobile devices, sought a bank that they could visit whenever they wanted, not whenever they needed. KakaoBank's fast remittance service and zero-rate service between existing connected customers based on a messenger app called KakaoTalk are examples of creating new businesses through consumer big data connections. In other words, this is representative of a digital innovation that combines elements of digital and banking services to transform them into new businesses.

2015
Financial Services Commission announces a plan for online-only banks

2016
Acquires full license for online-only bank operation

2017
KakaoBank founded

2019
Exceeds 10 million customers

5. Digital Transformation

• Eliminating cost in banking experience with digital technology

In 2015, when KakaoBank appeared, online banking was not a new service for customers at all. While existing banks were providing online and mobile banking services, KakaoBank had to show differences in all aspects of its management strategy and business plan in order to prove its differentiation as an internet-only bank and to receive full license. KakaoBank focused on eliminating various "costs" that can be experienced in the conventional banking experience through digital technology. It introduced a digital authentication system that allows users to quickly authenticate themselves and open a bank account without having to meet in person, as well as lower overseas remittance fees, streamline payment processes to reduce merchant payment fees, and enable remittance via messenger without having to enter a long account number.

• Introducing fun digital services

KakaoBank created the Meeting Account, which enables real-time dues tracking, in response to split fee payment trends that encourage users to pay their own dues each time they meet. And Safe Box can be used to collect large amounts of money for customers' own purposes. KakaoBank also launched a piggy bank function that automatically saves according to the setting, and shows the collected amount as a product that can be bought with the savings.

• Partnership with other operators

Collaboration with fintech and techpin companies: Cooperation in the development of artificial intelligence, security and contactless technology.

• Introduction of AI-based Kakao Chatbot

Kakao Chatbot is a simple ordering solution that allows customers to easily place and receive orders conveniently even during times of high order volumes. KakaoBank and KakaoPay can handle everything from ordering to paying to applying coupons all in one place.

6. Reward

• No. 1 in monthly active users

Has reached about 10 million monthly active users and ranks No.1 among Korean mobile banking apps from 2019 to 2020.

• Brand image

Selected as the best bank in Korea by Asia Money in 2021. It was the first time an internet-only bank was selected as the best bank in Korea.

FOCUS

NEOBANKS

"The world's banking industry is at a crossroads."

• **This statement is a part of the Global Banking Annual Report published by McKinsey & Company, a global consulting firm, at the end of 2020.** The analysis came as fintech firms' fierce race coincided with the slowing growth of the banking industry. In addition, McKinsey said that one out of three global banks is in danger of extinction, adding, "The banking industry is on the decline, and we are at the last stop." The competitors of commercial banks are IT companies, not traditional banks.

• **LAC is a region full of customs and traditions, which makes it unique and full of opportunities.** This uniqueness leads us to the emergence of fintech, which has been on the rise, and it is estimated that 60% of these emerged between 2014 and 2016 and have become a small engine to increase the productivity of countries and reduce digital divides. In this context, countries such as Brazil and Mexico have the largest number of fintech ventures, where Brazil has around 230 companies, followed by Mexico with 180 (IDB, 2017). In Brazil, for example, there is a fintech company, Biva Serviços Financeiros S.A., founded in 2014, whose mission is to connect, simplify and improve the financial lives of the people to whom they provide their services, through a 100% digital platform (Biva, 2021).

• Neobanks are financial institutions that give customers an efficient alternative to traditional banks. They are frequently founded by fintech startups and, like current banks, perform loan business and deposit functions through the acquisition of a bank license (license). However, the biggest difference is that neobanks operate only using non-face-to-face digital channels, unlike existing banks, which operate in branches. Therefore, the bank is called a digital or mobile bank, and in Korea it is called an internet bank.

One of the biggest competitive advantages of a neobank is its low commission, which is almost free. Because they have no branches or stores, which cost money to operate, they can provide paid services much more cheaply than traditional banks. Neobanks are becoming an inevitable trend as millennials emerge as the main consumers and prefer mobile as a financial service channel.

• C-level leaders at neobanks are making bold decisions that are having a big impact. KakaoBank, which gave up its PC version and released only its mobile version to break away from the existing limited financial authentication services, is a case in point. Neobanks have the challenge of reliably serving high levels of traffic while also responding quickly to business needs. As traditional architectures are difficult to solve, distributed micro-services and cloud-based architectures need to be implemented. For example, KakaoBank applied AI to its "deposit bank" service, which was launched in 2020, for customer service. If you have changed in an account linked to a piggy bank, it is automatically saved. With the use of underlying technologies, data processing and machine learning pipelines have been developed, as well as AI and operation methods. These technologies have also been used to develop credit rating models for medium-interest loan instruments.


ZENITH
I PARK

DIGITAL TECHNOLOGY CREATES NEW AGRICULTURAL BUSINESSES

- An agricultural business without farmland

- A telecommunications company digitizes cultivation methods and leverages scientific farming using data

Since 2010, digital companies in LAC have increased their market value 36 fold, while non-digital companies have decreased their corporate value.

(Technolatinas 2021, 2021)

EVOLUTION OF MARKET CAPITALIZATION OF PUBLICY-LISTED DIGITAL AND TRADITIONAL COMPANIES FROM LAC BETWEEN 2010 AND 2020

Technolatinas 2021: the LAC startup ecosystem comes of age, Ignacio Peña, IDB LAB and Surfing Tsunamis, 2021.

An agricultural business without farmland

N.THING

1. DX Type

Digital transformation converging industries

2. Company/Organization/Individual

N.THING – **SMEs, Annual Revenue $173,490, Est. 2014**

3. Sector

Digital farming

4. Story

A small digital farming startup is pioneering new agricultural business by offering solutions to make food even on barren land. N.THING is an IoT-based smart farm company established in 2014. It supplies a modular vertical farm called Planty Cube that can grow vegetables in containers. By applying IoT technology, it optimized and automated the environment for cultivation. Furthermore, the cultivation area can be expanded by simply adding containers.

2013
N.THING's original idea, Planty, wins grand prize at the Global K-Startup Contest of the Ministry of Science, ICP and Future Planning

2014
N.THING corporation founded

2015
Elected as K-Global 300 by KDB - Ministry of Science and Technology Information and Communication

2019
Awarded Best Innovation Award in the Smart City Category at CES 2020 (first time an agricultural start-up is awarded the Innovation Award at CES)

2020
Participates in the Seoul IoT smart farm operation project

5. Digital Transformation

• Defying the uncertainty of agriculture with digital technology

N.THING decided to use digital technology to control the environmental uncertainty that traditional agriculture must face. N.THING Cube Farm is a comprehensive agricultural solution that includes vertical farms made with modular containers, automated operating systems and operational services. Its purpose is to enable uniform production and supply of local fresh vegetables throughout the year. This solution detects and analyzes internal temperature, light, humidity, irrigation conditions, carbon dioxide concentration and controls the optimal growth environment with the collected data. That's because all devices in the N.THING Cube Farm are connected to the cube cloud through IoT technology. The manager can check the current status of cultivation on mobile and remotely control the farm environment if necessary. In addition, all wireless communications are secured by encryption.

• New agricultural products

Based on these agricultural environmental control technologies and task automation technologies, N.THING is also conducting research and development on special crops and high value-added crops and challenging the control of crop ingredients and taste without pesticides or genetic manipulation. For example, N.THING has a patented functional vegetable cultivation technology for patients with diabetes and kidney disease. These patent-based functional vegetables such as low potassium lettuce can be supplied to hospitals and diabetes centers.

6. Reward

• Innovative productivity enhancing solution

The digital control solution increases production per unit by 100 times and reduces water use by 98% compared to traditional agricultural methods.

• Promoted brand image:

Won the Best Innovation Award in the Smart City Category in CES 2020

A telecommunications company digitizes cultivation methods and leverages scientific farming using data

1. DX Type

Digital transformation converging industries, Telecommunications + Data + Agriculture

2. Company/Organization/Individual

- SKT – **Conglomerate, Annual Revenue US $16 billion, Est. 1984**
- Sejong City

3. Sector

Digital farming

4. Story

SKT supplies affordable ICT equipment to many farms to build a data collection foundation for big data, a platform that connects central servers and IoT sensors, and to provide various information to farms by utilizing collected information. To build smart farms, SKT has offered growers an intelligent irrigation solution and a way to apply for government subsidies. An intelligent irrigation and maintenance solution uses the IoT platform to analyze information needed to grow crop, monitoring temperature, humidity and precipitation in real time and automatically calculating necessary water and nutrients. Remote monitoring using mobile devices is possible, which also helps with labor shortages.

This seems to have been influenced by Korea's 6th Industrial Promotion Act. The official name of the sixth industry sector in Korea is rural convergence and complex industries. Currently, the Ministry of Agriculture, Food and Rural Affairs is awarding rural convergence industry business certificates to sixth industrial operators after screening them in consideration of potential growth. The rural convergence industry business certification system fosters core management entities by certifying farmers and agricultural corporations. It was introduced to create new added value by linking agriculture (primary industry) and secondary industries.

SKT has decided to actively pursue sixth industries by creating ICT-based creative villages and distribution experience tourism. The plan calls for applying smart technology to distribution of agricultural products in rural villages by utilizing ICT and activating direct transactions through agricultural funds. Smart learning solutions such as robot coding using smart robots introduced by SKT, safety services such as a care system for the elderly living alone, and an IoT-based disaster guidance system are also being applied. In addition, SKT opens ICT infrastructure free of charge to partner companies that are cooperating with agricultural ICT businesses. It is opening its cloud DB infrastructure to manufacturers of equipment to store growth data that is integrated into smart farms.

2014
SKT starts pilot operation of IoT-based farm

2015
SKT builds smart farm in Sejong-si and launches smart farm-produce market

2016
Participates in measures to accelerate the spread of smart farms announced by the Ministry of Agriculture

2017
IoT livestock management service "Live Care" launches

2018
Provides intelligent water supply and management solutions to establish smart farms for potato growers

2020
Establishes a LoRa (long-range IoT connectivity) network

5. Digital Transformation

- **Smart Farm+ App**

By exploiting the advantages of being a telecommunications company, SKT's existing ICT technologies were utilized, as well as remote control services using the network. The Smart Farm+ app is more intuitive in the user interface (UI) than the existing app developed by the government. Additional services such as weather information from the Korea Meteorological Administration are also available.

- **Smart Greenhouse**

This is a technology that monitors window opening, nutrition, temperature, humidity, and CO2 level for an optimal growth environment for crops, using PCs or smartphones. Through sensors that measure temperature, humidity, wind, soil, acidity, etc., it receives the information about the green house in real time and creates an optimal environment.

- **Smart Farm Live Care**

Live Care is a livestock healthcare management service that monitors changes in the temperatures of cows and helps prevent diseases and management of the estrus cycle. When a bio capsule is placed in the reticulum of a cow, it communicates with the SKT server and transfers real-time data, allowing the user to access features such as real-time monitoring, alarms, dashboards and community.

- **Cooperation with the City**

SKT jointly established the smart farm facility in cooperation with Sejong-si (City) and constructed a training center to create a test environment suitable for domestic farmers. It acts as a testbed, with various experiments being conducted while growing and selling crops.due to smart farms.

6. Reward

- **Effect of introducing smart farms**

It is expected that the introduction of smart farms will increase productivity by 32.1%, reduce self-labor time by 13.7%, and reduce damage from pests by 6.3%.

- **DT Solution Promotion**

By increasing usability-based technology, it is encouraging the participation of farmers unfamiliar with digital solutions.

- **An increase in the number of returning farmers**

The number of households returning to farming in Korea in their 30s or younger increased 12.7% from 1,209 in 2019 to 1,362 in 2020, the highest ever. According to a survey by the Ministry of Agriculture, Food and Rural Affairs of Korea, 39.1% of the respondents said that the reason for returning to farming was the likely development of agriculture due to smart farms.

FOCUS

SMART FARM

• **The current agriculture sector is experiencing various economic challenges and severe labor shortages due to the aging of the rural population and the outflow of people to urban areas.** IoT technology is emerging along with the recent influx of information and communication technology that started with the 4G network, and it is creating innovative value by converging with various industries.

• **In LAC, digital transformation in the agricultural sector has been gradually increasing**, and although this sector generally does not have technologies that facilitate its processes, a wide range of digital solutions are currently being developed throughout the region, becoming the main tools for local entrepreneurs (IDB, 2019).

• **Such is the case with the startup Space AG, which was founded in Peru in 2017.** This startup offers its customers an integrated digital platform for crop management through data collection, which is captured by drones, satellites and sensors. Subsequently, the information is processed, the result of which allows agribusiness companies to upload their own crop information and generate predictive models, using AI. This supports farmers in decision making, as well as maximizes their crop yields and optimizes the use of critical resources such as water, fertilizers and pesticides. In addition, it helps them detect anomalies, such as pests, diseases, water stress, etc. (Space-AG, 2021).

• **Agriculture as a primary industry is not likely to grow by itself, but when combined with advanced science and technology, it can have high growth potential to become a state-of-the-art industry.** Futurists call agriculture the sixth industry. In Korea, the sixth industry, which was expanded by the convergence of IoT technology and agriculture, has allowed agriculture to develop from labor-intensive industries into IT-based high value-added convergence industries.

The smart farm, a key component of the high-tech agricultural sixth industry, consists of sensors and devices related to farm control as a platform. Smart farm has recently developed into a way to analyze the growing environment of crops and provide growth environment data.

4. IMPLICATIONS AND SUGGESTIONS

4.1.

EXPECTATIONS OF THE LAC REGION FROM KOREA'S LESSONS

In this section, we derive insights into how LAC opportunities match Korea's potential, with a perspective of co-prosperity and partnership rather than a one-way, lessons-learned approach. We re-examined the efficiency of Korea's various government policies, paradigm shift, infrastructure capabilities, and ICT policies, and reconfirm that digital transformation is taking place efficiently and quickly through cooperation across industries in the public and private sectors. Similarly, LAC government policymakers have a high interest in digital transformation, and companies hope to add value through digital transformation. However, with the lack of a built-in environment, lack of awareness, inefficiency in implementing government policies, and lack of capital, the question remains: "How should digital transformation be done?"

Expectations are high in both the LAC region and Korea. Opportunities in the LAC region are particularly high among technology-driven startups in the region. Technology-based startups called Technolatina have been born, and a bright future is expected. Korea's digital transformation experience may be good inspiration for their continued success. It can also be seen as an opportunity for Korean companies to develop further based on observation of regional characteristics in LAC that they have never seen in Korea. Currently, Korean digital companies are focusing only on domestic services. By expanding their perspective, they will be able to instill the spirit of challenge at a global level through the exchange with LAC.

To provide a well-documented example, Korea's Born2Global, the main Korean government agency under the Ministry of Science and ICT (MSIT), which functions as Korea's global deep tech startup accelerator, has recently launched a new initiative with IDB Lab, called the LAC-Korea Deep Tech Exchange Program. The program is aimed at promoting global exchanges for LAC deep tech ecosystems to solve short-term (mitigation) and medium-term (economic recovery and reopening) challenges caused by COVID-19. In collaboration with IDB Lab and LAC ecosystem players, the collaboration will source Korean and LAC companies with innovative solutions in key sectors. Ecosystem builders of both regions include accelerators, company builders, universities and corporate venture hubs, which will partner to demonstrate joint innovation, cope with challenges and prepare for the post-COVID digital transformation.

It is necessary to present a framework for growth strategies in major industrial sectors of LAC, which are highly likely to develop, in order to create digital transformation strategies in the LAC region, as seen in subchapters 3.1 and 3.2. The information below provides learnings and a proposal obtained by comprehensively analyzing and aggregating various previous literature and examples, which will serve as a reference for policymakers in the LAC region and industry workers in the private sector.

4.2.

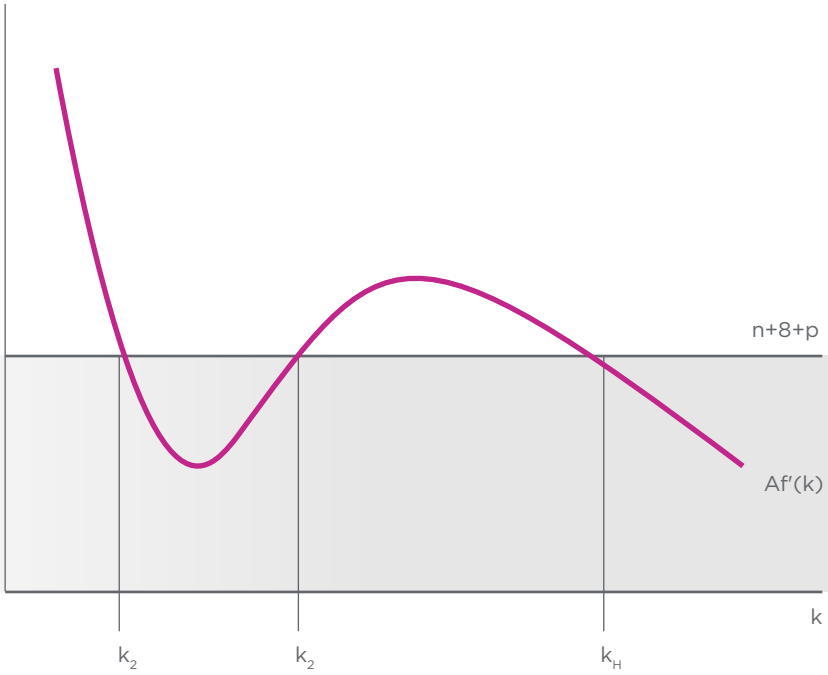
KEY TAKEAWAYS TO UNLOCK DX IN LAC

In this section, lessons that LAC and Korea can share are summarized based on Korea's public and corporate experiences leading the way at the starting line. Effective strategies follow best practices. Various ways to convert to digital technology can be learned by understanding the history of development in Korea, and implementing best practices in LAC through knowledge transfer and experience may be a valid strategy. However, this process should include customization that suits the characteristics of the LAC region, especially for major industries with high potential for development in the region, and the government and ICT industry's actions to support digital transformation will be important.

Digital Transformation for All Stakeholders, No Exceptions

As we saw in the previous Korean digital transformation cases, conglomerates, government agencies, small- and medium-sized companies, and citizens were able to become players in the evolution to digital transformation, which is becoming essential for all aspects of society. While the various stakeholders can be the protagonists of the digital transformation story, the government can be a powerful initiator. As we confirmed earlier, in Korea's experience, a 'big push' from the government in the form of financial and institutional support is essential, particularly in the initial stage of an industry's development. The below figure shows this development flow. Without a certain level of capital in the initial stage of development, the industry stops growing and gets trapped in poverty as shown in K_L in the figure. In other words, a large-scale investment is required in the initial stage of development for the industry to secure stable growth. Since the initial development of the ICT industry often entails high risks and large-scale investment, it seems desirable for the government to play a certain role in the initial stage of development in the form of consistent executive leadership support, including funding, coordination among agencies and the revision of laws and regulations. The government-driven model is one of the proven options for the development of the ICT industry.

FIGURE 13. THE POVERTY TRAP (BARRO AND SALA-I-MARTIN, 2004)



Infrastructure: Massive Requirements for Strategic Investment in Digital Transformation

Earlier, we looked at the history of the Korean government leading the establishment of ICT infrastructure since the 1990s. The government-led infrastructure building eventually became the foundation for the nation's diverse innovation players to ensure digital transformation. Building infrastructure is the first step that should be taken to unlock the LAC digital transformation. The geographic scale of LAC is the biggest difference when compared to Korea. The following examples illustrate how to strengthen the infrastructure.

In Brazil, E-Digital includes strategic action to improve or implement internet access to ICTs. This is established as one enabler, encompassing all four pillars of digital transformation. With strategic action comes a list of goals, including:

- connecting 22,000 public schools, urban and rural, with high-speed broadband access, via terrestrial or satellite network

- accelerating the process of implementing 4G networks using the 700 MHz radio frequency band, especially in municipalities that do not depend on the release of this band in the transition to digital TV

- making long-term investments

- articulating between data communication infrastructure initiatives (e.g., national critical infrastructure), computing (e.g., high-performance computing - HPC) and data storage to meet the needs of cyber-infrastructure services for large science and technology projects, in cooperation with companies that are highly demanding of ICT, supporting RD&I projects in each sector. (MCTIC, 2018). In total there are nine actions in the strategic infrastructure plan that can unlock digital transformation and be an example to LAC.

The other example is the Chilean agenda, which plans for strategic connectivity to provide and achieve universal connectivity: access for all to high-speed and quality networks, through the modernization of the infrastructure for connectivity, with a focus on public services such as health, education, security and municipalities as one of its measures (Chile government, 2013).

Convergence: Smart Industries for an Integrated Ecosystem

Digital transformation creates new opportunities by converging industries. Traditional agriculture produces products and tools for making products. In the era of digital transformation, agriculture has merged with the information and communication industry to create new businesses such as agricultural environmental control technology and development of new crops based on environmental control and data analysis.

Modern production value chains emphasize interaction across all industries. In that sense, mutually exclusive practices in silos are obsolete. Fortunately, governments and industry representatives are aware of the concurrent needs and seek integration between all participants and have developed policies to adopt integrative technology. Despite awareness and these actions, challenges remain and hamper the integration. Therefore, a suitable strategy is to follow the action plan to foster integration and information flow across industries.

As an example, the circular economy approach in Brazil, specifically in the health sector, is intentional, for it not only integrates suppliers and providers, but also adopts digital transformation to exploit technology and create a sustainable ecosystem where individuals take action and information is promptly shared along with the entire ecosystem and between industries.

Leadership: A Key Factor for The Transformation

Digital leadership is needed for digital transformation. No matter how large or small their organization may be, decision-makers should have a consciousness appropriate for the era of digital transformation. Digital leadership should not be equated with technocracy; it is not merely a higher awareness or knowledge about digital technology, but the willingness and ability to draw out the organization's digital capabilities in a horizontal manner. If a business leader wants to expand the business through digital transformation and increase the organization's work efficiency, a declaration is not enough for meaningful change. Digital leadership and a systematic strategy should follow.

As in the Korean case, the government is an important leader for digital transformation at the national level. In this sense, the first step is to initiate an ecosystem where it is possible to receive, promote and foster technology. In general, the creation of the digital transformation regulatory frameworks in the LAC region is performed by most governments; however, the lack of vision or technology comprehension will result in a flawed digital transformation policy framework. Moreover, when a policy is developed and only superficially accepted, the execution stage will remain a big challenge.

Therefore, the proposed plan argues that true leaders are required; not only to develop a framework, but also to understand the scope of technology, and propose a feasible roadmap for the LAC region. In this sense, knowledge sharing is required so people will have a clear scope and comprehension of technology. The ultimate objective is to empower people to become true leaders. Consequently, they will lead and develop intentional digital transformation policies, contribute to execution and share their knowledge with others.

4.3.

PROPOSING A FRAMEWORK FOR FACILITATING DIGITAL TRANSFORMATION

LAC countries have different levels of potential that can be unlocked with the support of digital technologies. Digital transformation represents an opportunity for the region to increase its competitiveness and its productivity to improve its people's welfare. The Korean experience sheds light on the following conditions for adequate promotion and implementation of digital transformation.

First, digital transformation requires high-level government leadership to establish strong synergies with civil society. Governments must design their own digital transformation strategy and roadmap, with commitment to proper implementation. Governments must provide a regulatory framework that facilitates digital transformation implementation as well as satisfactory management of cybersecurity concerns.

Second, digital transformation develops and evolves in a changing context. So, it requires a holistic and dynamic approach in the design and implementation of public policies. It provokes policymakers to rethink and to adapt the design of their current policies related to labor, education, health, industry and environment.

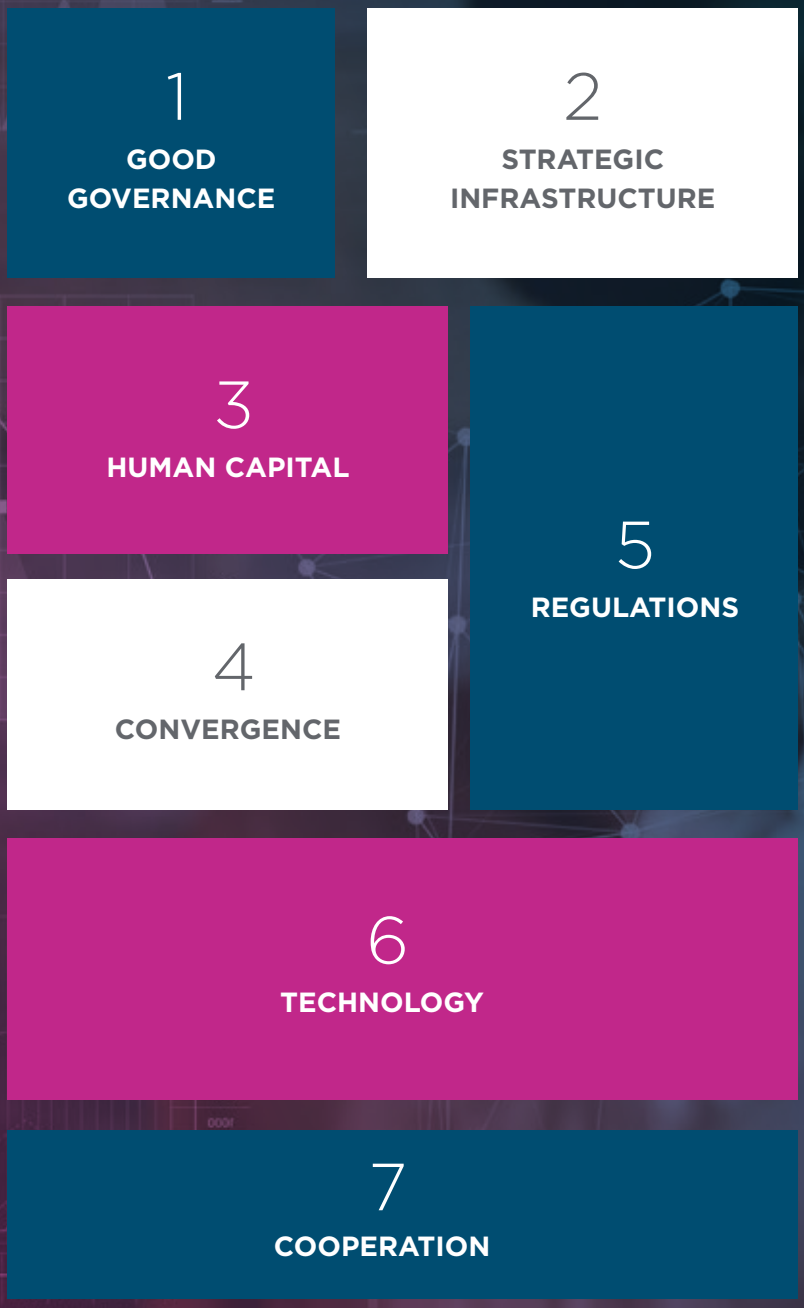
Third, digital transformation requires the aggressive promotion and development of new digital skills in the workforce to ensure the efficiency of the labor market.

Fourth, digital transformation requires a strategic investment in infrastructure and technology that provides better tools and connectivity for economic players to achieve their organizational objectives effectively.

Fifth, digital transformation requires strengthening relationships with key cooperation partners that have been demonstrating an effective transition to a digital economy. Their support and involvement are vital for the establishment of digital transformation strategies to overcome the challenges that the region has in its different industries.

Considering the previous lessons, the information in this document proposes a framework that aims to facilitate and promote digital transformation in the region across different industries. This framework defines seven fundamental pillars and their strategic actions for the region: **good governance, strategic infrastructure, human capital, convergence, regulations, technology and cooperation.**

FIGURE 14.
THE DIGITAL TRANSFORMATION FACILITATION FRAMEWORK



1

Good governance

Digital transformation needs effective governance that is responsible for designing national strategies, coordinating efforts and monitoring the results of policies to make appropriate policy adjustments based on the dynamic environment that characterizes digital transformation.

2

Strategic infrastructure

Governments must prioritize their investments by focusing their resources on strategic infrastructures that allow better accessibility, coverage and connectivity. In that sense, they should examine the possibilities of associations they can make with the private sector.

3

Human capital

Digital transformation needs human talent to be prepared by improving their skills, abilities and knowledge according to labor demand and the management of digital technologies.

4

Convergence

Governments need to provide incentives to encourage ICT convergence across their countries' industries to improve their productivity and competitiveness.

5

Regulations

The LAC regulatory framework should be characterized by adaptive sandbox synergies aimed to support the interaction between regulatory entities, innovation agencies, the private sector and the scientific community.

6

Technology

Technology cooperation turns into a driver for improving the competitiveness in the LAC region. The main goal is to identify from the Korean experience the cases most likely to be successfully implemented in the region.

7

Cooperation

The Korea-LAC interaction refers to the implementation of priority actions of a regional nature, to provide synergies to reinforce the principles of South-South cooperation and stimulate North-South cooperation.

4.3.2.

PROPOSED STRATEGIC ACTIONS TO FACILITATE DX IN LAC

Under the proposed 7-pillar framework it is possible to have strategic actions as described below.

1 | Good Governance

- To establish specialized government promotion agencies and associations in ICT fields
- To promote people's participation in governance, informatization and knowledge sharing
- To establish a Public-Private Committee for ICT implementations and DX initiatives.
- To make specific budgets and funds for ICT with particular purposes
- To publicize continuous transparency and accountability of government activities

2 Strategic infrastructure

• To invest in strategic infrastructure that increases the coverage and quality of connectivity

• To promote building IT industry infrastructure as a top priority

• To design and implement high-speed network roadmaps based on IoT, cloud computing and blockchain

• To support a national digitization plan and e-Government transaction systems

• To create and keep supporting tech-based education infrastructure and environment

3 Human Capital

• To develop and promote the long-term vision of the hyper-connected society and the skills of the future

• To improve the interaction between the industry and academic sector to ensure human talent meets labor demand

• To focus on investing in inclusive IT skills training programs

• To deliver advanced IT courses for entrepreneurs, workers, public officials, students, etc.

• To strengthen online education systems for universities and provide job training

• To give preferential treatment to ICT, science and engineering sectors to reduce brain drain

4 Convergence

• To make use of public-private partnerships as collaborative win-win assets

• To establish and support ICT R&D institutes with proper assessments

• To create public awareness of DX by designing an ICT convergence communications strategy

• To support demo days, hackathons and startup events to promote ICT convergence in all industrial sectors

• To host special showcase events for startups to share ideas about their innovative products and services

5 Regulations

- To enact special laws that support plans and funds to promote informatization
- To create a legal framework to protect personal data and prevent violation of privacy
- To take deregulation measures on unnecessary acts to ease entry barriers of promising sectors
- To designate special zones such as free economic zones and deregulatory sandboxes for developing and operating businesses

6 Technology

- To share the vision of new businesses development in alignment with DX technology roadmaps
- To encourage technology cooperation among universities, research institutes and private enterprises
- To recognize the importance of intellectual property and promote investment in technology development
- To foster transition to a DX society and support the development of smart city transformation
- To encourage entrepreneurship of startups and SMEs to move toward Fourth Digital Revolution technologies.

7 Cooperation

- To institutionalize a novel international cooperation model that allows for addressing various structural challenges in LAC through global cooperation
- To exploit current bilateral trade agreements
- To promote the long-term investment supported by the international development bank system.
- To reinforce international R&D cooperation
- To strengthen North-South cooperation agreements aimed to implement DX in the region

4.3.3.

DIGITAL COOPERATION BETWEEN LAC AND KOREA

Cooperation projects between LAC and Korea can be achieved through a number of cooperative channels formed so far. In terms of multilateral development banks, Korea joined the **IDB** in 2005 and has deposited a total of US $140 million in trust funds and operated more than 180 technology cooperation projects. In 2020, Korea became the permanent board member of **Central American Bank for Economic Integration (CABEI)**, investing US $630 million.

In terms of multilateral consultative channels, Korea is a member of the Forum for **East Asia and Latin America Cooperation (FEALAC),** a consultative body for promoting cooperation in fields such as economics, science and technology. And the **Korea-LAC Future Cooperation Forum** has been held by the Ministry of Foreign Affairs of Korea since 2016. Government and diplomatic officials, as well as business professionals and students have participated in the forum. The 2020 forum was co-hosted by the Ministry of Foreign Affairs and the Ministry of Health and Welfare with the theme of "Quarantine and Health Cooperation" between Korea and Latin America. It featured sessions to strengthen quarantine and health solidarity between Korea and Latin America after COVID-19. Specifically, in 2021, **Korea-LAC Digital Cooperation Forum** was hosted by the Ministry of Foreign Affairs and the Ministry of Science and ICT, with the theme "Digital Innovation and Inclusiveness Partnership." It contributed to advancing post COVID-19 Korea-LAC relations by meeting LAC countries' requests for cooperation in ICT and digital innovation. Forums are a starting point to come up with ways of mutually beneficial cooperation by linking Korea's Digital New Deal policy and LAC's digital transformation policy.

In terms of business exchange channels, there is the **Korea-LAC Business** Summit hosted by IDB, the Export-Import Bank of Korea, the Ministry of Finance and Economy, and KOTRA. The event is the largest Latin American economic cooperation project held in Korea, involving high-level government officials and companies from 26 member countries of the Bank of America. It was held in 2007, 2011, 2015, 2017 and 2019. About 100 Latin American companies and 250 Korean companies participated in the 2019 summit. And about 500 business consultations were conducted, with five MoUs signed. Also, seminars were held to establish cooperative partnerships with the themes of digital health care cooperation, smart city and high-tech agriculture. In particular, health care seminars were prepared to share policies and current status in the digital health care sector of each country and to seek ways to cooperate in the future. During the seminar, Korea shared the Korea Health Promotion Agency's mobile health care project and solutions to diabetes management at Seoul National University Bundang Hospital; Peru shared Peru's smart medical promotion status and prospects; and Colombia shared telemedicine cases at Antioquia State Medical School. This summit is not just a channel for large companies and institutions. **Korea-LAC Startup Pitch Day** was also held at the most recent summit. A total of 24 startups in the bio, health, agriculture, fintech and satellite industries participated in the event; 18 were from Argentina, Uruguay and Colombia, and six were from Korea. Among the 24 companies that participated in the exchange event, companies with innovative digital technologies and products across sectors such as agriculture, e-commerce, energy, finance, and health care participated, as shown in the table below.

TABLE 10.
KOREA-LAC STARTUP PITCH DAY - KOREA-LAC BUSINESS SUMMIT 2019

SECTOR	PRODUCT	PARTICIPANT
#Agriculture	Detection system for irrigation and water-related problems through data collection and modeling using ultrasonic sensors, temperature sensors and water level sensors	**Sikron** (Uruguay)
#E-commerce	Global e-commerce management platform for global sellers and brands covering the entire process from customs clearance fees, customs smart calculation and agency, target marketing, to imported goods meet local customers, and logistics partners and suppliers	**nocnoc** (Uruguay)
#Energy #Agriculture #Finance	Low earth orbit satellite-based information platform for oil and gas infrastructure and transport, agricultural management, market intelligence, disaster monitoring, etc.	**SATELLOGIC** (Argentina)
#Finance	Financial information platform that provides information on credit cards, investment loans, car and housing loans and investment portfolios	**MAREIGUA** (Colombia)
#Healthcare #Education	3D printing simulator for surgeons to practice prior to surgery	**mirai 3D** (Argentina)
#Healthcare	Customized digital solutions to prevent and improve hearing loss by analyzing hearing test results	**uSound** (Argentina)
#Healthcare #Education	Online medical professional education service provided by medical professors and specialists	**EviMed** (Uruguay)

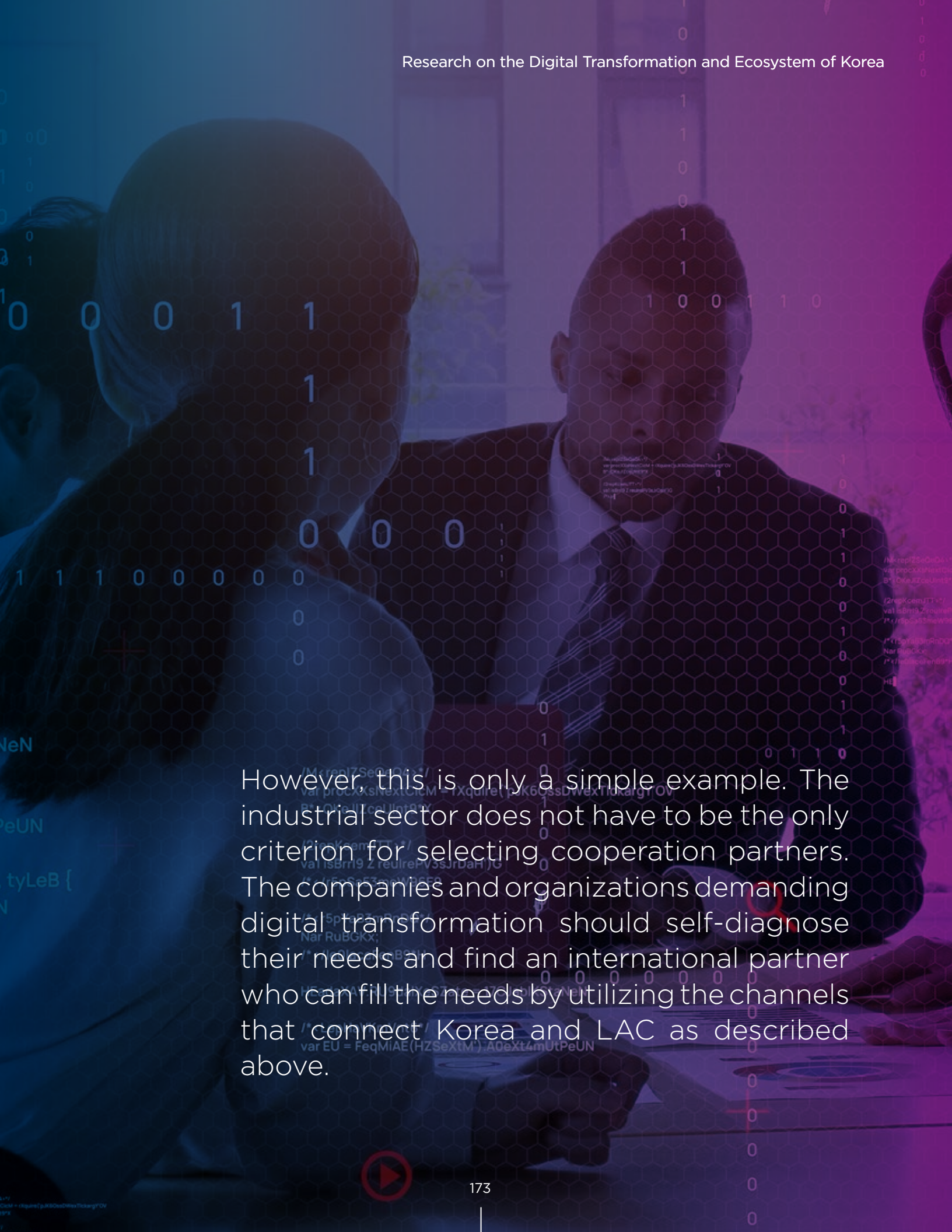
This type of startup exchange between Korea and LAC is also found in the **LAC-Korea Deep Tech Exchange Program**. The program has been operated by the Born2Global Center and IDB Lab since 2020, discovering excellent startups in Latin America and helping them match with innovative technology companies in Korea. Online meetings were held to overcome the pandemic situation, and a total of five LAC-Korea joint venture partnerships were created by July 2021. The five joint ventures that achieved final approval from IDB Lab are as follows: Advance (Colombia)-Shopl (Korea), which develops employee work management and education solutions; Avancargo (Argentina)-Coconut Silo (Korea), which develops a logistics transportation platform solution for cargo drivers; Proximity (Peru)-Virnect (Korea), which develops VR safety education and AR maintenance solution; Maestrik (Mexico)-Riiid (Korea), which develops personalized English learning courses through AI diagnosis; and Wheel the World (Chile)-Dot (Korea), which develops a self-travel guide service for blind people. The approved joint ventures receive consultation and funding necessary for empirical commercialization.

In terms of technology cooperative channels, there is the **Korea-Latin America Food & Agriculture Cooperation Initiative (KoLFACI)**. This initiative was established in 2014, led by the Korean Rural Development Administration, and promotes the sharing of knowledge and experience in agricultural technology between LAC and Korea. KoLFACI has been developing and applying technologies to the agricultural environment of Latin America by carrying out about 10 agricultural research projects so far. The Korean Rural Development Administration also has operated the **KOPIA (Korea Program for International Cooperation in Agricultural Technology) Center** in five LAC countries including Paraguay, Bolivia, Ecuador, Dominican Republic and Nicaragua. The KOPIA Center develops, demonstrates and distributes customized agricultural technologies for each country in cooperation with local agricultural research institutes. In addition, in 2021, the Korean government dispatched agricultural cooperation delegations to three Latin American countries including Colombia, Costa Rica, and Guatemala, to discuss expanding cooperation projects using KoLFACI and KOPIA.

In the cooperative atmosphere created by the various channels, roughly following the design example below is suggested. Based on the proposed framework to facilitate digital transformation in LAC, an opportunity has been identified to design a Technology Cooperation Pilot Project between LAC and Korea. The idea is to pair LAC companies based on the industrial sector of the companies and institutes mentioned in the stories of digital transformation in Korea.

FIGURE 15. DIGITAL COOPERATION PILOT PROJECTS BETWEEN LAC AND KOREA

This report has identified nine strategic sectors where technology transfer may have a major impact in the DX: industry, government, health, agriculture, education, finance, energy, retail and communications. From each strategic sector, Korean successful companies in DX were identified as a referent to deploy a Technology Transfer Pilot Project. In the case of LAC, eleven companies which currently are involved in DX were identified as suitable recipients of the technology transfer from the potential Korean companies. In this sense, Korean companies and institutions from these sectors might coach LAC companies in how these specific digital technologies can be implemented in their organizations. For example, Posco, a Korean industrial company, might coach Sinteplast (a LAC industrial company) in its path to become a smart factory.



However, this is only a simple example. The industrial sector does not have to be the only criterion for selecting cooperation partners. The companies and organizations demanding digital transformation should self-diagnose their needs and find an international partner who can fill the needs by utilizing the channels that connect Korea and LAC as described above.

4.4.

INSIGHTS ON DX INNOVATION

As Brian Solis, a world-renowned anthropologist, said,

“Digital transformation is more about humans than digital.”

We take the standpoint that digital transformation applies to all people, including experts, policymakers, practitioners, entrepreneurs, capitalists and investors, innovators, and even ordinary citizens. Now we are witnessing that this change has surpassed the boundaries of technology and now points to a future where digital transformation will affect everyone. We look back to the beginning of this report to find our definition of digital transformation.

Digital transformation is the bundle of actions directed by companies, institutions, governments, social groups and citizens as a strategy aimed to improve the quality of life of people as customers by providing better conditions in their daily lives with the adoption of disruptive digital technologies such as internet 5G, IoT, artificial intelligence, augmented reality, virtual reality, big data and machine learning.

At this point, it is necessary to ask these questions again.

“How will digital transformation change the world? What will be the potential of digital transformation? What is the future of digital transformation? And particularly, will digital transformation work as the enabler of a prosperous economy for a region?”

Digital used to be about IT, and now it is becoming a business and part of society itself. Not only is it an enabler, but it is the seed of innovation for the future. Before, in the public sector, the World Bank Development Report (2016) set the expectation that digital technology would make the world more prosperous and inclusive, and traditional development challenges were preventing the digital revolution from fulfilling its transformative potential. Today, OECD (2020) shows that COVID-19 has accelerated the use of digital technology to build resilience and bridge divides. The world has realized what we need for the sake of mankind’s progress, and we are in the process of transformation.

An example of digital transformation discussion in the public sector is the United Nations Project Office on Governance (UNPOG). It focused on strengthening public governance and accelerating innovation, where digital transformation also plays an important role. Presentations on the approaches and strategies to accelerate digital transformation, and the experience of digital transformation policy initiatives, are shared with the world. The lessons we highlight in this report and learn from the Korean government are as follows: The Korean government shifted the paradigm of ICT to information technology; established ICT government agencies and R&D promotion agencies to promote the initiatives; enacted IT-related laws under strong government leadership and commitment; and last, linked with the private sector for partnership, creating value for the society.

Looking at the steps in digital transformation innovation, we recall the well-known proverb, “Rise from humble beginnings.” Korea started from close to nothing and rose to be one of the most digital-friendly nations in the world. During the journey through development, each footstep is marked with important decisions from the government, enactment of promotion laws, national initiatives with high risk and return, and ultimately all this bears fruit. Koreans anticipated that the world would discuss the potential of digital transformation. The country has not ceased to develop its path toward that very goal. The solution lies in policy, infrastructure, technology, convergence, and leadership.

Having hope was important in Korea's digital transformation, which was achieved despite adverse conditions because of continuous drive and devotion. The LAC region is endowed with much more favorable conditions and even larger potential. Questions and doubts will be answered as the plans are initiated and implemented. We hope that digital transformation will open up the frontiers of what we can do together. With strategic action, digital transformation is in the near future or already present. It’s time to tell your own digital transformation story.

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