Innovation Strategies for the Transition to the New Economic Paradigm

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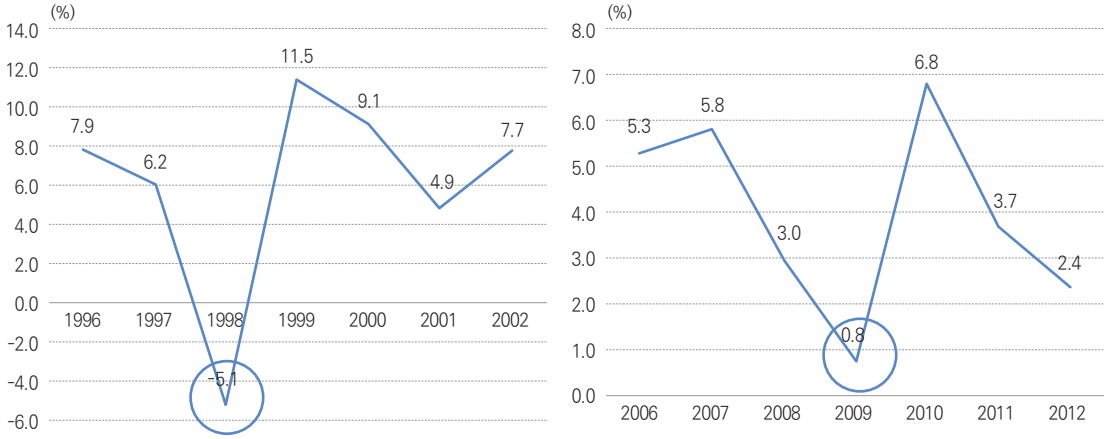
1. The COVID-19 Pandemic and the New Economic Paradigm

(1) Global Economic Crises and the Korean Economy

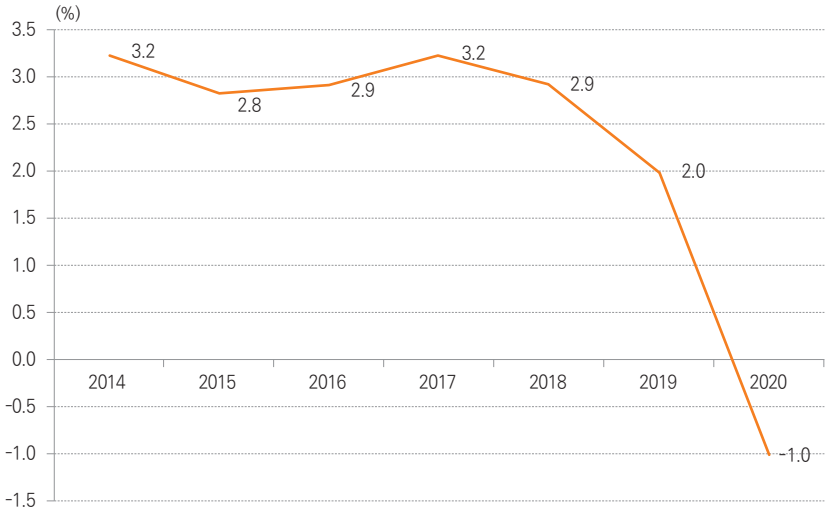
Over recent decades, the Korean economy has experienced three economic crises: the IMF crisis, the Global Financial Crisis and the COVID-19 pandemic. Even though those economic crises had different causes, they have had (and continue to have) drastic repercussions in the Korean economy. In the case of the IMF crisis, which occurred in 1997 due to the failure of foreign currency reserves in Korea, industrial restructuring was accelerated across the whole economic system. In comparison, the Global Financial Crisis was caused by a global credit crunch triggered by subprime mortgages in the USA. This crisis also had a large and serious impact on the Korean economy, owing to its high dependency on foreign economies. As indicated

Figure 1. GDP Growth Rates during the IMF and Global Financial Crises



Source: Bank of Korea, Economic Statistics System.

Figure 2. Slowdown in the GDP Growth Rate Due to COVID-19 Pandemic



Source: Bank of Korea, Economic Statistics System.

in Figure 1, GDP growth rates in 1998 and 2009 were -5.1 percent and 0.8 percent, respectively, which shows the significance of the impacts of those crises on the Korean economy.

Compared with previous economic crises, the SARS-CoV-2 virus that ignited a global pandemic at the end of 2019 has made very serious impacts on not only the economy but also on social, cultural, political, educational, and national systems. In Korea, from an economic point of view, the pandemic was manifested through a rapid slowdown in the GDP growth rate, to negative one percent in 2020, as shown in Figure 2. At this time, when we are facing a most serious economic crisis, it is necessary to tackle the problem of how to overcome it by learning from how previous economic crises pushed the Korean economy in the right direction.

This paper deals with how the COVID-19 pandemic has affected our economy and society, and which approaches and strategies we need to overcome the crisis. In this view, it is noticeable that the COVID-19 pandemic has created a new economic paradigm in a negative way, but on the other hand, the ongoing Fourth Industrial Revolution (4IR) is bringing about an economic paradigm shift in a positive way. This means that we need to analyze not only risk but also opportunity factors arising from the COVID-19 pandemic to exploit this situation positively in various ways and in multiple sectors.

(2) Economic Paradigm Shift due to the COVID-19 Pandemic

As everyone knows, the COVID-19 pandemic has changed behavior patterns in a wide range of areas, including online consumption, telecommuting, contactless marketing and delivery,

non-face-to-face communication, and so on. This shift from previous lifestyle patterns to new non-face-to-face and contactless ones is leading fundamental structural changes in the overall economy. In this paper, the risk and challenge factors due to COVID-19 pandemic are identified from the economic point of view, on the demand and supply sides, as follows.

1) Demand Side

- a variety of online demand
- increase of complex and high-end demand
- convergence of offline and online demand

On the demand side, there has been increase in the amount and variety of online demand, because of the control and management of face-to-face meetings, the opening of designated commercial places and collective work in specified locations. These actions created flourishing online-based needs that can be basically developed into differentiated demand. This can induce firms to enhance advertising and marketing by customizing products and services in accordance with differentiated needs and demands. On the other hand, the COVID-19 pandemic has spurred a combination of offline and online demand that can be seen a trend in terms of cost-saving or enhanced convenience, which has been more activated in this environment.

On the supply side, we can consider three sectors: technology, management, and the supply value chain, as follows.

2) Supply Side

① Technology Sector
- high utilization of online based technology
- utilization of 4IR industries
- spread of technology convergence

② Management Sector
- expansion of online marketing
- production automation, establishment of work-at-home environment
- customizing of online-based differentiated demand
- creation of new business models based on online demand and consumption

③ Value Chain
- weakening of global or domestic supply value chain networks

On the supply side, first, in the technology sector, it is important to consider the high level of utilization of online and network-based technologies such as the Internet of Things (IoT), big data, cloud computing, blockchain, artificial intelligence (AI) and others. These cutting-edge technologies also power 4IR industries that are expected to lead to a new economic society. However, a rapidly-changing economic society needs more than to simply utilize these high-end technologies, because society is ready to be more dramatically changed into a cyber or

networked world through a decentralized management system. It is clear that the COVID-19 pandemic triggered the proliferation of decentralized and distributed networks in a direction toward more decentralized authorization, control, transactions and so on. In addition, a decentralized and enhanced society will give new opportunities for intensified utilization of cyber and network-related technologies via layered content, platforms and infrastructure. This also will promote the convergence of cutting-edge technologies.

Secondly, in the management sector, our society is facing a new working environment where it is necessary to work at home and carry out non-face-to-face and contactless marketing, production and deliveries as much as possible must be considered. Moreover, it is also important to create new business models by utilizing information on customized or high-end demand. These changes in the management sector can be reinforced more efficiently and effectively by utilizing cutting-edge technologies such as big data, AI, cloud computing, blockchain, next-generation ICT technologies, augmented reality (AR) and virtual reality (VR) and others.

Finally, in the supply value chain, it should be considered that global and domestic supply value chain networks have weakened as the COVID-19 pandemic has caused difficulties for the providers of raw materials and intermediary products owing to sudden drops in final demand and consumption. Another serious problem is that it is difficult to rebuild damaged supply value chain networks even if business recovers amid growing demand and consumption, including so-called "revenge spending" after the COVID-19 pandemic. This means that it is necessary to establish and develop new value chain networks that can be strategically diversified.

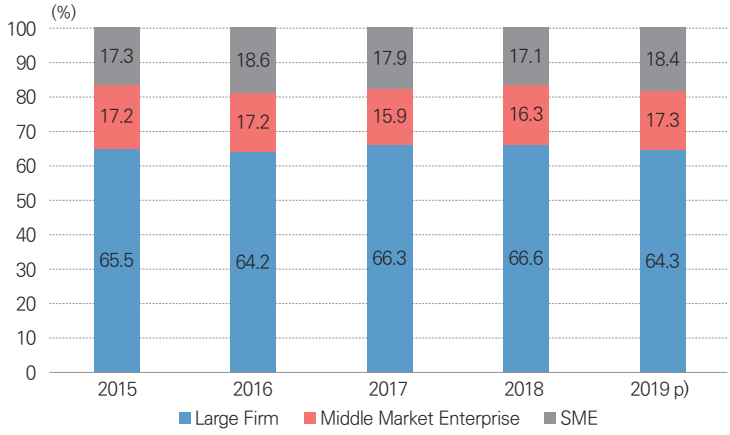
2. Innovation Strategies for Business Sectors

(1) Innovation Directions Before the COVID-19 Pandemic

In the previous section, I suggested that the COVID-19 pandemic presents our economic society with a wide variety of risks and challenge factors under a new economic paradigm. In this section, I show how the Korean business sector has made efforts to overcome the previous crises and furthermore how the country has secured stable economic development through innovative economic activities following economic crises and especially the Global Financial Crisis.

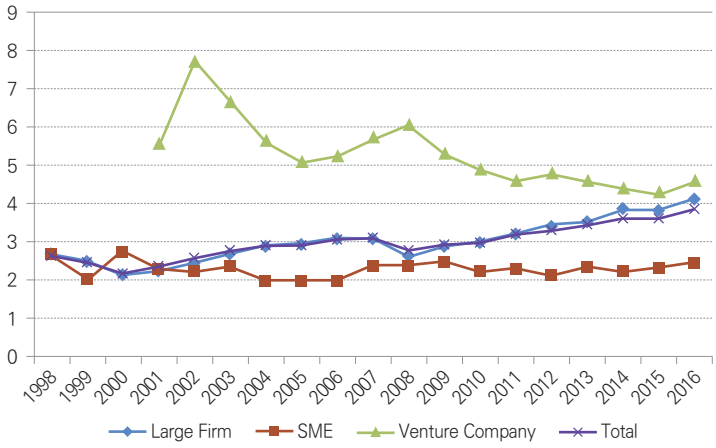
Focusing on open innovation, this paper suggests that Korean the business sector had tried to conduct R&D investment by introducing or applying high-tech technologies, which can be expressed as higher R&D intensity led by large-sized firms. Basically, the Korean economy has an export-led market structure where large-sized firms have played dominant roles in producing innovations in key industries. Figure 3

Figure 3. Export Ratios by Firm Size



Source: KOSTAT, KCS, Business Trade Statistics.

Figure 4. Ratios of R&D Expenditure to Sales



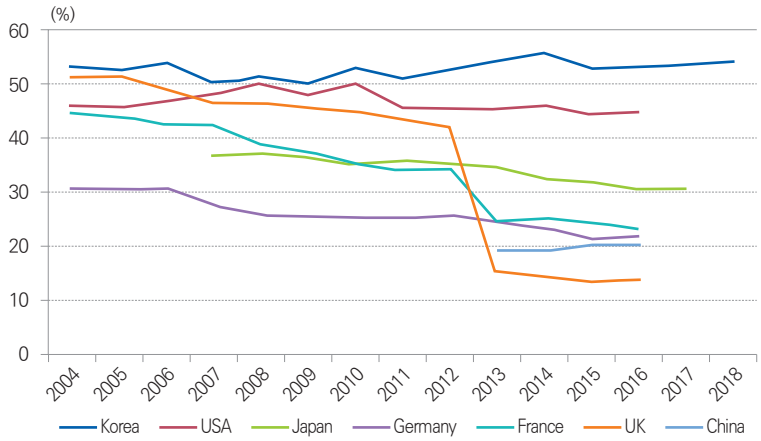
Source: KISTEP, Survey of Research and Development in Korea.

shows that large-sized firm account for more than 60 percent of export performance until recent years.

As shown in Figure 4, except for a sudden downfall in 2008, R&D intensities were continually increasing in terms of the ratio of R&D expenditure to sales, and this was led by large-sized firms. In the case of venture companies, the ratios had been gradually decreasing, with a decline notable beginning in 2003 after the bursting of the dot-com bubble.

In addition to high R&D intensity in the business sector, in the Korean economy, innovation has been focused in select industries, as shown in Figure 5. Compared with other advanced countries such as the USA, Japan, Germany, France, UK, and China, Korean firms have the highest ratio R&D investment in high-tech in-

Figure 5. Percentage of R&D Expenditure for High-tech Industries

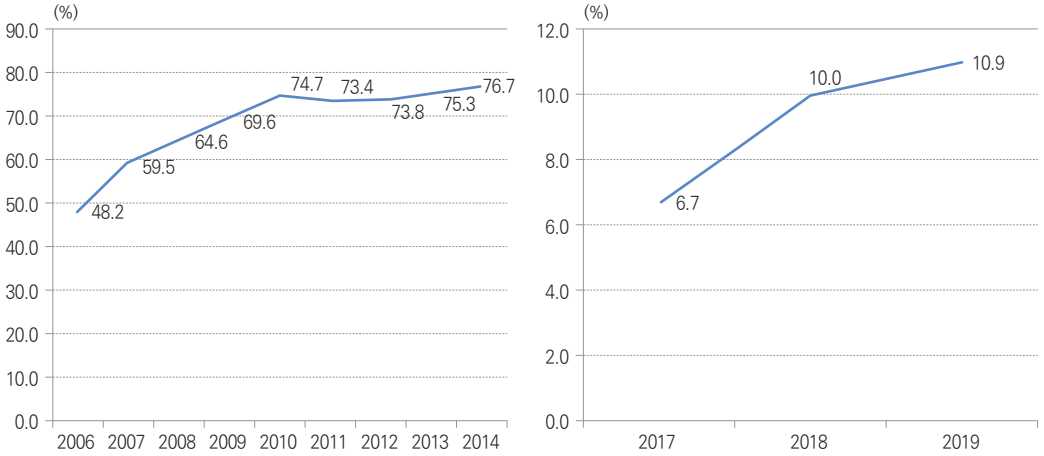


Source: KISPEP, Survey of Research and Development in Korea; OECD, Main Science and Technology Indicators 2015-1, 2019.

dustries.[1] This means that the Korean economy has concentrated R&D capacity in high-tech industries, which allowed these firms to attain international competitiveness and reinforce R&D capabilities despite higher costs in the early stages of investment.

From the perspective of innovation strategy, meanwhile, at the earlier stage of industrial development it was important for the business sector to adopt and apply high-tech technologies such as IT. In recent years, it is also important to utilize 4IR-related technologies,

Figure 6. E-business and 4IR Technology Utilization Ratio in the Manufacturing Industry



Source: KOSTAT, Report on the Survey of Business Activities.

1 The high-tech industries correspond to pharmaceutical, aerospace, and computer/electronic/optical industry.

especially in the manufacturing industry. Figure 6 shows that from 2006 to 2014, e-business in Korea was gradually utilized more actively in the manufacturing industries, from 48.2 percent in 2006 to 76.7 percent in 2014, as indicated in the left graph. By comparison, the utilization of 4IR technologies has increased from 6.7 in 2017 to 10.9 percent in 2019 in the manufacturing industry, as indicated in the right graph.

(2) Innovation Strategies for the New Economic Paradigm

In the COVID-19 pandemic, the business sector needs to develop innovation strategies not only to overcome the COVID-19 pandemic but also to take advantage of new opportunities and new markets. First, on the demand side, the following strategies are proposed:

1) Demand Side

- internet-based advertising and marketing
- customizing products and services by differentiating and developing demand groups
- creating new customer by suggesting new needs and demands

On the demand side, firms should strengthen internet-based advertising and marketing that is based on the collection and analysis of data and information over the internet. This can be connected to the customization of products and services by grouping and analyzing differentiated demand. Furthermore, this can lead to the creation of new business models by suggesting new needs and demands.

On the supply side, first, in the technology sector it is necessary to develop production automation by utilizing related technologies including smart factories, 3D printing, robots, AI, big data and others. In addition, it is also necessary to promote the utilization of 4IR technologies and convergent technologies to develop applications guaranteeing high value-added management activities such as customized production.

In the management sector, it is important to expand digitization and e-enable management processes including advertising, marketing, production, sales and logistics, which can help provide online-based products and services. However such efforts may prove futile without differentiating diversified demand and customizing products and services accordingly, necessary condition to enhance business under the new economic paradigm.

Finally, in the supply value chain, it is important to guarantee stability in the value chain network, a necessary step in the recovery of businesses affected by the COVID-19 pandemic. Furthermore, in this situation, it is also important to expand value chain networks as part of a cooperative response to new environmental, technological, chemical and emissions regulations. The following summarizes the suggestions mentioned above.

2) Supply

① Technology

- production automation by utilizing smart factories, 3D printing, robots, AI, big data, etc.
- technology utilization for customized production
- application technology through the utilization of 4IR technologies and converging technologies

② Management

- digitization and e-enabling in advertising, marketing, production, sales and logistics for online and automation
- customized management for differentiated demand
- resource management for creating new business models and entering new markets
- external participation for interaction in product and service design

③ Value Chain

- strengthening of stability-guaranteed value chain network
- cooperative responses to environmental, technological, chemical and CO2 emissions regulations, etc.

3. Policy Implications for Business Innovation

In this section, this paper suggests strategic policy directions for supporting business innovation activities by recognizing the importance and role of policy in leading businesses innovation paths.

First, it is important to provide businesses with support platforms to meet firms' needs on the demand and supply sides, as reviewed in the previous section. On the demand side, for example, over a marketing support platform, firms could utilize online-based technologies such as AI, big data, cloud computing, blockchain, which could make internet-based advertising and marketing more organized and developed. Table 1 summarizes risks and challenge factors, innovation strategies in the business sector and finally innovation support policies on the demand side.

By comparison, on the supply side, a technology support platform can be provided to support a wide range of R&D activities, for example, access to technology information, connecting and interacting with other actors, establishing partnerships (collaboration and cooperation) and so on. This strategy is also important for

Table 1. Innovation Strategies for the New Economic Paradigm on Demand Side

Risks and Challenge Factor	Innovative Strategy-Business	Business Support Policy
· a variety of online demand · increase in complex and high-end demand · convergence of offline and online demand	· internet-based advertising and marketing · customizing products and services · creating new customer classes	· marketing support platform for business to utilize AI, big data, cloud computing, blockchain, etc. · networking business cooperation over platform

the supply value chain in terms of strengthening cooperative networking.

The following case can be illustrated as a technology support platform (here, system or organization):

Case 1. The organization of a Convergence Innovation Support Group that provides expert support, such as technology information provision and consultations with researchers from 32 public research institutes.[2] Furthermore, if necessary, R&D collaboration between businesses and public researchers can be carried out, with the potential to commercialize the partnership.

From the perspective of the supply value chain, it is also important to provide a value chain support platform, which is not much different from the technology support platform in that it aims to provide networking support and enable interactions with other economic actors. The main difference between the value chain and technology support platform comes

Table 2. Innovation Strategies for the New Economic Paradigm on the Supply Side

	Risks and Challenge Factors	Innovative Strategy–Business	Business Support Policy
Technology	· high utilization of online based technology · utilization of 4IR industries · spread of technology convergence	· production automation by utilizing smart factories, 3D printing, robots, AI, big data, etc. · technology utilization for customized production · application technology through the utilization of 4IR and converging technologies	· easy access to vast web of technology information · promoting cooperation between R&D actors and business
Management	· expansion of online marketing · production automation, establishment of work-at-home environment · customization of online-based differentiated demand · creation of new business models	· digitization and e-enabling in advertising, marketing, production, sales and logistics processes for online and automation · customized management for differentiated demand · resource management for creating new business models and entering new markets · external participation and interaction in product and service design	· establishing blockchain-based management support networks · developing an ecosystem consisting of content, platforms, and infrastructure for value-added networking (e.g., both demander and supplier are participating, combining the real and cyber worlds)
Value Chain	· weakening of global or domestic supply value chain network	· strengthening of stability-guaranteed value chain network · cooperative response to environmental, technological, chemical, carbon dioxide emissions regulations, etc.	· establishment of national cooperation network · national support system including monitoring and technology cooperation · win-win relationship maintenance between affiliates including large firms and subcontractors · technology support from public research institutes

2 The organization was established according to the Act on Special Measures for the Enforcement of Competitiveness in Materials, Components, and Equipment Industries.

from whether the partnership has a vertical or horizontal relationship. In addition, it is noticeable that the business needs the other level of cooperation system to respond appropriately to a wide variety of regulations regarding the environment, technology, chemical substances, carbon dioxide emissions, and so on.[3]

For this case, the following can be illustrated:

Case 2. The Materials Components Supply and Demand Countermeasures Support Center organization has supported the business sector by providing (i) information on Japan export-regulated items (ii) R&D and emergency management safety money support (iii) directly providing materials and components to those in need of help.[4]

In view that it is important for the policy to lead the business sector to innovation paths, it is also necessary for the government to take the initiative in organizing and establishing platforms or networks. In doing this, it is important to use 4IR technologies, particularly blockchain, to secure meaningful and value-added networking. Furthermore, such policies should be connected to the establishment of an ecosystem comprising content, platforms and infrastructure for the value-added network. As examples, we can illustrate the new concept of networks where both demanders and suppliers are participating; a network in which both players can contribute to economic or production activities (as well as game activities) through the real and cyber worlds. Table 2 summarizes risks and challenge factors, business innovation strategies and finally innovation support policies on the supply side.

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3 In fact, Korean economy recently experienced export restrictions regarding basic semiconductor technologies from Japan.
4 The center is under the administration of the Ministry of Trade, Industry and Energy.