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# Securing the National Growth Power with the Fourth Industrial Revolution

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*Abstract*

This study summarizes the viewpoints of the Fourth Industrial Revolution. In many ways, this study emphasized the need to adopt the concept of Choi in policymaking by emphasizing technology-social innovation and human-centered social orientation, and further emphasized the technology-based innovation that actively utilizes technology to solve social and economic problems. Based on this concept of the Fourth Industrial Revolution, it presented the problems facing our economy and industry recently, the lack of responsiveness to the Fourth Industrial Revolution, the lack of an inter-industrial convergence economy, and the lack of ability to respond to government and legislation. To solve these problems, the research team worked together with the public on the basis of science and technology-based social innovation strategies, which are used as drivers for solving social challenges, and the public and private sector to strengthen the platform-type future response system. In order to implement such policies, the government proposed reform of regulations on barriers to entry into the market by implementing an open platform state management system through enhanced government coordination. We also presented the need to develop a 4th Industrial Revolution response level diagnostic model for diagnosing the level of response to the 4th Industrial Revolution and supporting education consulting to enhance capacity as a policy agenda. This study presents a comprehensive definition of the concept of the Fourth Industrial Revolution, and it can be seen as a suggestion of how the government should change its response to the Fourth Industrial Revolution and the need to assess the level of industrial site.

*Keywords*: the 4th Industrial Revolution, Industrial Renaissance Strategy, intelligent information technology

## 1. Introduction

In economic terms, the effect of the Fourth Industrial Revolution is explained as a very important variable factor. In particular, the importance of changes in how to recognize and respond to the Fourth Industrial Revolution is greatly emphasized in the future national growth. McKinsey (2016), for example, shows Korea's macroeconomic effect, predicting that the total economic impact on the industry of intelligent information technology will be as high as 355 trillion KRW in 2030, with the economic effect of manufacturing expected between 50 and 95 trillion KRW.[1)]

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1) In addition, the total was expected to be 180 to 355 trillion KRW, including the industrial sector (60 to 110 trillion KRW), finance (25 to 50 trillion won), distribution (10 to 30 trillion KRW), and other industry sectors (40 to 80 trillion KRW). (McKinsey, 2016).

In particular, the dramatic increase in productivity due to production flexibility through reduction of production costs using intelligent information technology is also seen as a major change factor in the Fourth Industrial Revolution. For example, a virtual physics system could dramatically reduce the cost of production and operation management of manufacturing industries and, through a case study in Germany, the cost of complexity that is difficult to calculate among actual types of costs (60%)[2]. Despite such positive economic effects, however, the outlook for the Fourth Industrial Revolution and our future direction in the government and parliament is not very bright. For example, the National Assembly's 2017 data on the bill sent a warning to Korea in the direction of policy change during the Fourth Industrial Revolution.

First of all, the growth of venture startups such as expansion of business opportunities and reduction of start-up costs was expected to accelerate the destruction of boundaries between industries through convergence between technology and industry, and the possibility of market structure shifting from supply led to demand led to worse among companies. Moreover, in terms of the Mega economic order, the entire world has accelerated into a low-growth era since the 2008 global financial crisis, and the Korean economy can also be synchronized and this phenomenon is seen in recent low economic growth rates[3]. This phenomenon is not a problem of our own but the global economy, and it is time for major economies to slow down their global policy drive as they are shifting their policies toward the Fourth Industrial Revolution that will keep pace with global trends.

In this situation, the present study presents an industrial Renaissance strategy in which intelligent information technology can be incorporated into existing industries as an alternative to analyzing the current situation facing our industrial policies during the 4th Industrial Revolution and to overcome it. In other words, IT infrastructure and intelligent information technology with global competitiveness are required to foster high-tech manufacturing industries by linking IoT, AI, and Big Data and to support policies for developing new policies to advance into global markets.

## 2. A theoretical and institutional review of the Fourth Industrial Revolution

### 2.1 Cooling the power of growth in Korea

With Korea's growth engine cooling down, it is urgent to find a new source of growth engine. The situation is also easy to see in the economic growth rate, which has fallen sharply since 2008. In fact, Korea's economic growth rate has sharply declined from 10.53 percent in the 1970s to 6.68 percent in the 1990s, 5.39 percent in 2000-2007 and 3.10 percent in 2008-2015. An increasing number of Korean engines are showing signs of a decline in the country's manufacturing purchasing index and corporate earnings rate, and an era of low-growth New Normal with low national competitiveness.

Jin and Bang (2018) emphasized the need for a "technology-social innovation" and "industrial innovation" strategy as strategies for sustainable development of Korea in this era of low growth. In addition to these preceding studies, the study highlights the need for three industrial policies: 1) The government emphasizes the need for industrial Renaissance Strategy to revitalize traditional industrial structure based on convergence and innovation, 2) the need for scientific technology-based social innovation to use the innovation as the driver for solving national challenges, and 3) the platform system for strengthening of three nation's future responsiveness.

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2) Inventory cost was between 30 and 40%, manufacturing cost from 30% to 20%; logistical cost from 10 to 20%; and complexity (Schröder, 2017).

3) Korea's economic growth rate (%): 10.53 → 6.68 (1990s) → 5.39 (2000~2007) → 3.10 (2008~2015)

## 2.2 Definition of the concept of the Fourth Industrial Revolution and multi-disciplinary system

The term 'industrial revolution' refers to the change of the technological, economic and social systems in industry (Scheer, 2013). Especially, the circumstances of work, the changes of life conditions and the economic wealth are in focus. In the middle of the 18th century, the first movement in terms of industry started in England. Following it, the USA and other European countries like Germany began to change agricultural society into an industrial one (Dombrowski and Wagner, 2014)

The concept of the Fourth Industrial Revolution and its implications vary widely depending on academic background and industrial position. Despite diverse views, the nation`s science and technology community recognizes the Fourth Industrial Revolution as the most important national agenda of Korea`s future strategy (Federation of Science and Technology, 2017).[4] This phenomenon can be seen as a sign that the Fourth Industrial Revolution is not a change confined to certain industrial areas, but a limit in terms of specific studies and single scientific techniques. In this regard, Jin and Park (2017) emphasized the need for wide-ranging industrial revolution through prior study meta-analysis, big data analysis and expert opinion surveys.

Despite this diversity and wide scope, the study based on the etymology and its uses of the Fourth Industrial Revolution was able to make a major distinction as follows.

Figure 1. Approach to the 4th Industrial Revolution

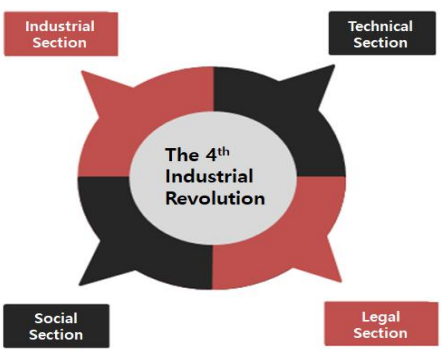
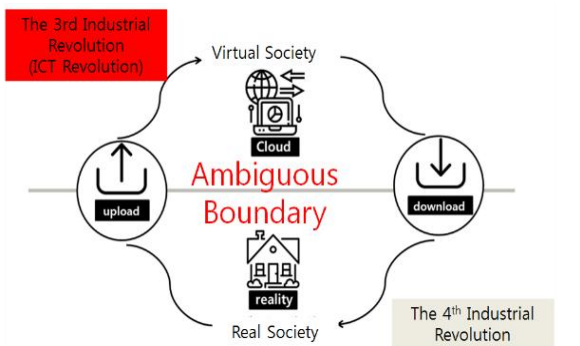



Figure 2. Relation between the 3rd and 4th Revolution




Source: Reconfiguring Jin and Park (2017)

a) It is used to emphasize the start of a new type of industrial economy that is differentiated from the past ones.[5] This emphasizes differentiation and isolation from the past and emphasizes the new industrial economic system of the new era, which can be distinguished by the principle of innovation and social structural innovation (Carr, 1940) and others. Rifkin(2017), on the other hand, refutes that it is too early to declare an end even though the potential of the digital revolution has not been demonstrated.[6]

b) This can be seen as an emphasis on convergence and innovation between industries and technologies since

4) In particular, AI (24 percent), convergence new industry (22 percent), and digital innovation (17 percent) of manufacturing are presented.

5) The 1st Industrial Revolution: mechanical production facilities powered by water and stream, 2nd Industrial Revolution: mass production based on the division of labor powered by electrical energy, and the 3rd Industrial Revolution: automation through introduction of electronics and IT.

6) The term "4th Industrial Revolution" originated from studies such as Carr (1940) and Rostow (1985) in these studies, and the term "4th Industrial Revolution" was a different term from the past. Meanwhile, Riffkin (2017) stresses the role of the Third Industrial Revolution, arguing that it is too early to declare a termination without any potential for the digital revolution.

the Davos Forum in 2016. This shows that the concept of convergence among the primary industries is being changed into one that emphasizes innovative social development and changes in economic structure through convergence between different industries (Schwab, 2016). This is an intermediate step toward the Fourth Industrial Revolution, where convergence and human focus are emphasized in a traditional bureaucratic society, and it has a socio-chemical view on the establishment of the 3rd Industrial Revolution information age.

c) The 3rd Industrial Revolution (ICT Revolution) can be defined as creating social and economic benefits by putting real-world information on cyberspace[7]. On the other hand, the Fourth Industrial Revolution reduces the goods and benefits of cyberspace to the physical world and merges the activities of the real world and the cyberspace that were clearly distinguished. Production activities of the 4th Industrial Revolution are economic activities that generate entirely new economic and social benefits through convergence of industries, services and information not limited to a specific space. As reality and cyber interactions continue to strengthen, the boundaries gradually fade and are reconstructed in the form of numerous possibilities. In this way, the Fourth Industrial Revolution is clearly distinct from the previous Third industrial revolution.

d) Recently, there have been many cases of redefining the values of human-centered societies and future social values for social structural reform. This position is based on the approach of the Fourth Industrial Revolution, not technology. In this regard, it is often defined as a new future (hope) society where social structure disease (difficult) can be solved through the use of science and technology.

### 2.3 Policy review on the Fourth Industrial Revolution in other countries

Major countries such as the U.S., Germany, and Japan have been preparing for the Fourth Industrial Revolution through multilateral and indirect policy establishment and support aimed at reviving the manufacturing industry. The group that leads the Fourth Industrial Revolution is advanced countries based on the U.S., while the U.S., Germany and Japan have overwhelming competitiveness in terms of government policies, level of innovation and infrastructure (Han, 2017). While the direction of national policies for responding to the Fourth Industrial Revolution may be somewhat different, the objectives for the revival of major ICT technologies and manufacturing industries can be quite similar.

In particular, the U.S. is leading the way in the private sector with high technology and financial power while Germany is building up the Industry 4.0 ecosystem through its manufacturing system. Japan is preparing for the Fourth Industrial Revolution through a national response, and China is emerging on the basis of massive capital and market. The characteristics of these overseas cases are that the maintenance of other propulsion systems is very important for sharing roles of the private and government, emphasizing the future responsiveness of state administration, and thus the Fourth Industrial Revolution drive system by fusion and coalition.

Even in the case of major countries, policy is being switched at the beginning of the Fourth Industrial Revolution in terms of considering social changes and examining the wide impact of public and private sectors, rather than actively adjusting to changes in technology. And it actively reflects the needs of society and the needs of the field through the assurance and up-to-date collection of activities of various participants. Germany's swift re-establishment of its national strategy to respond to rapid environmental changes, detailed policy design for Japan's industrial sites, and strengthening U.S. innovative networks that strengthen ties with private citizens will be examples. This shift in public management tells us that public management in the age of industrialization is no longer suitable for the Fourth Industrial Revolution. Just as leading countries set up and position strategies

7) Current innovations in all fields of Information and Communication Technologies (ICT) lead to huge progress. Among the most important ICT innovations are new driver-technologies like the "Internet of Things, "Internet of Services"(Abramovic et. al., 2015).

in consideration of their national capabilities, historical background, industrial competitiveness, and national consensus, Korea needs a comprehensive approach to social-technology systems, value-oriented policy building, and new problem solving. Considering both macro and micro aspects at the same time is possible through the application of new technologies such as big data and AI. And it is desirable to implement Korea's Fourth Industrial Revolution response strategy by taking advantage of the characteristics of the system change through strategic management in each specific area.

## 3. Current status and limitations of the Fourth Industrial Revolution in Korea

Korea lags behind technology and infrastructure-level legislation, while major advanced countries such as the United States are quickly preparing for the Fourth Industrial Revolution. The most representative case was Switzerland's No. 1 ranking in the fourth level of the Industrial Revolution (UBS, 2016; World Economic Forum), Japan's 12th, Germany's 13th and Korea's 25th. Although there have been many analyses and studies on the future of the Republic of Korea, this study is intended to redress the gap in institutional and technical use.

### 3.1 Legal and budget execution system needs to be improved

First, from an institutional perspective, Jin and Park (2017) pointed out the systemic and budgetary chaos that shows the nation's Fourth Industrial Revolution is not being overhauled.

In promoting the Fourth Industrial Revolution policy and forming a pan-government system to organize and implement budgets, there are now many ecological problems arising from granting its authority to the Fourth Industrial Revolution Committee, not to the Act but to the Presidential Decree. In other words, policies for the Fourth Industrial Revolution, which should be implemented in the direction of ministries, have ecological limitations that cannot be overcome with weak coordination and weak leading functions if implemented by subcommands rather than laws. In other words, the 4th Industrial Revolution Committee may propose new policy projects or coordinate projects between departments under the Government Organization Act, and it may have such legal authority. Indeed, due to these legal limitations, the Fourth Industrial Revolution Committee has not been granted the right to approve and vote on policies and budgets. Because of this reality, the Ministry of Information and Communication has given the functions and authority to actually promote the nation's Fourth Industrial Revolution, and the actual policy planning and implementation are being carried out by the Ministry of Science and Technology. Against this backdrop, it is difficult to cooperate with the Ministry of Strategy and Finance over the R&D budget right of the Ministry of Science and Technology's innovation division, such as the right to organize the budget and approve the plan.

In addition, confusion can arise due to the establishment of uncertain relations between the relevant departments for the growth of new industries and the government-prepared Fourth Industrial Revolution Act. In fact, laws from various fields need to be duplicated and supplemented, and the legal system for promoting the Fourth Industrial Revolution needs to be organized. By way of example, the Industrial Convergence Promotion Act (2016) and the Industrial Technology Innovation Promotion Act (2009) were enacted by the Ministry of Commerce, overlap with the "Special Act on Promotion of Information Communication and Activation of Convergence Promotion" (2014) established by the Ministry of Government Administration, causing much confusion in the Fourth Industrial Revolution.

These disagreements are emerging at major R&D sites. Of the 25 research institutes that are in charge of major R&D in Korea, the budget for the Fourth Industrial Revolution was 560.4 billion KRW (4.5 billion USD), which is only 11.2 percent of the total budget, which is a matter of priority. In particular, only 2 percent of the

total budget was found to be the convergence research project for interdisciplinary and linked industries, a key task of the Fourth Industrial Revolution, and many of the government's demands for improvement in the Fourth Industrial Revolution.

Table 1. Government-funded research institute budgeting for the Fourth Industrial Revolution (as is 2017)

| | Total amount of government research institute R&D budget | General projects | Total amount of the 4th industrial revolution projects | Total amount of convergence research projects |
|---|---|---|---|---|
| Budget | 4.5 billion/18 billion (USD) | 4 billion (USD) | 500 million (USD) | 90 million (USD) |
| Rate | 100% | 88.8% | 11.2% | 2% |

Source: The National Assembly (2017)

Moreover, the lack of future-oriented short-term projects (51.3% in short-term tasks less than 5 years), 13.1% in seven years, and no longer than 10 years in long-term projects are also important examples of Korea. This study is intended to raise a problem with the responsiveness of innovation. This study points out that the country's R&D policies are less responsive and future-oriented, and is a prime example of the weakening responsiveness of ICT technologies and the consequent increase in technological gap. Korea needs to pay attention to the widening gap between IT convergence technologies, which are the basis for the Fourth Industrial Revolution, and advanced countries.

As of 2008, the technological gap between the Korea and the U.S. has widened in the field of intelligence information technology, a new technology that follows the entry of the intelligence information society. This can be seen as a sign that there is a big problem with the government's response to the intelligence information technology community[8].

Table 2. The technology gap in Korea's IT convergence field compared to the U.S.

| Technologies | Cognitive Computing | I.o.T. | AI. Robot | Big-Data | Smart Car |
|---|---|---|---|---|---|
| Development gap | - 6.0Y | - 4.2Y | - 4.2Y | - 3.7Y | - 3.7Y |

Source: Dong-A Ilbo (2016.1.26.)

### 3.2 Increase the need for horizontal ecosystem structure

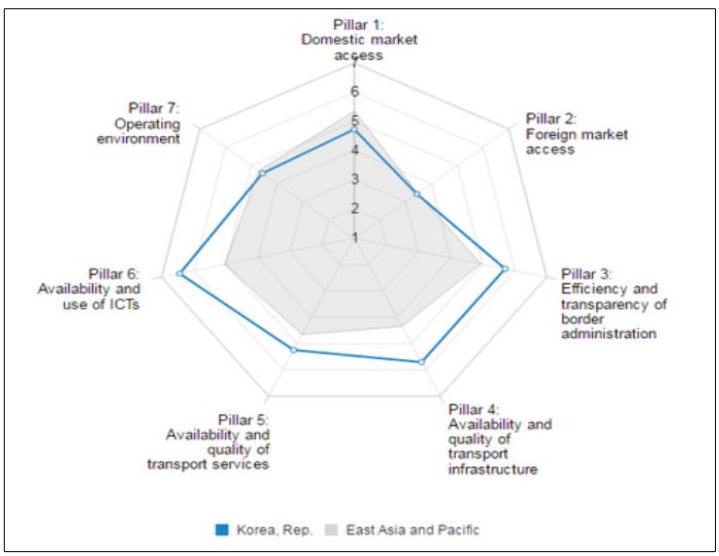
The Global Enabling Trade Index, which is announced biennially by the WEF(2016), shows that there is a problem with the accessibility of the Korean market. When Korea ranked the index based on distribution, administration, infrastructure, and business environment, it was found to be 27th, a relatively low ranking compared to Korea's high dependence on trade, suggesting that market regulations restrict the creation of new products and services[9]. These findings indirectly demonstrate that regulatory barriers are high in the market environment, which means that mitigation of regulations on entry into many markets can be a critical policy task in promoting the Fourth Industrial Revolution that emphasizes lateral convergence. Although the government is aware of these problems and presents them as a state agenda, the government has failed to implement a

8) The IT technology gap between Korea and the U.S. is only 1.3 years old. In comparison, Europe lags behind the U.S. in 0.7 years, Japan in 0.9 years, and China in 2.4 years, respectively.

9) Korea ranked 27th overall (99th in domestic market opening, 47th in business environment), and 4th out of 33 countries (WEF, 2016).

fast-paced regulation on entry into the market due to insufficient promotion systems that can lead to coordination and compromise with interest groups between industries and economies.

Figure 3. Korea's international trade environment index




Source: World Transitional Environment Index (WEF, 2016. 12)

The presence of such a high entry barrier in the market is a barrier to the creation of new industries or the convergence of industries in the 4th Industrial Revolution era. The biggest problem is that entry into the market is becoming more difficult, especially when a new economic system integrated with intelligence information technology and existing industries or services is created.

As shown in the examples of AI-based medical services, AI-based legal services, and self-driving cars that integrate intelligent information technology and medical services, the government is failing to drastically clean up market regulations or adjust itself to new services. In particular, small and medium-sized enterprises or start-up companies such as venture start-ups have failed to overcome the regulations of stakeholders in the market and even fail to enter the market.

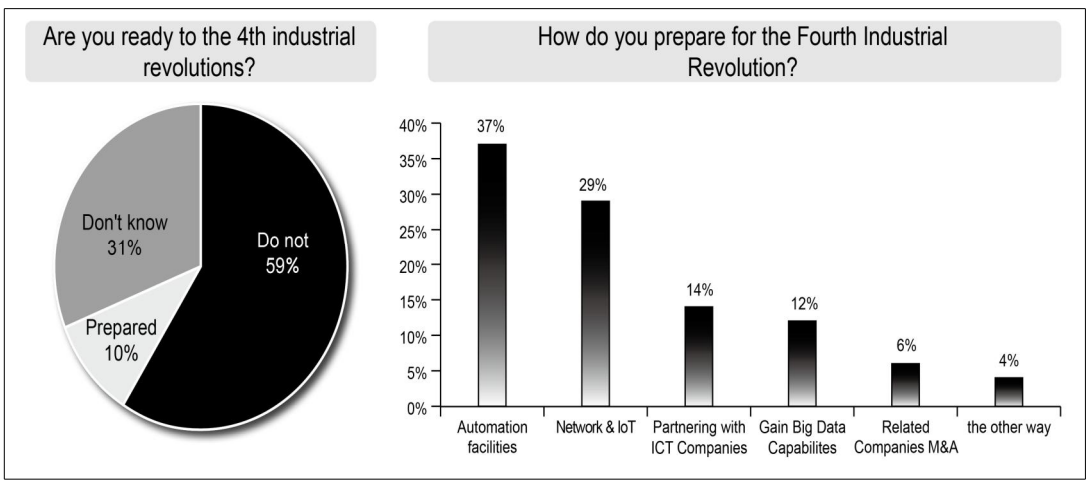
Fortunately, in the manufacturing sector, digitalization of manufacturing through 3D printing is an attempt to mitigate entry barriers to manufacturing technology and reduce production costs, and in this study, it is a case of technological-social innovation through technological innovation. In addition, the integration of big data and artificial intelligence, intelligence information technology, should be integrated into manufacturing, service, and society, thereby securing the optimal service value of products and services and enhancing new revenue. In particular, research on horizontal ecosystems that emphasize changes from vertical and rigid economic systems to horizontal and open network structures (improvement of platform business models) is required to reflect the need for horizontal cooperation among businesses in this policy.

### 3.3 Increase the level of civic engagement

It presents many difficulties for small and medium businesses to participate in the Fourth Industrial Revolution. First of all, limited development resources and capabilities are one of the biggest issues. The core

of digitalization is based on advanced IT systems, but small and medium-sized businesses with limited resources and IT capabilities have limited response and lack of high-cost investment in the latest intelligent information technology, making them unable to reduce investment costs and risk[10]. As a result, we can see that the corporate response to the Fourth Industrial Revolution is extremely low positive (response companies: 10% overall) and is mainly limited to automation and telecommunication facilities expansion.

Figure 4. Summary of Status Survey on recognition and response of private sector




Source: Herald Business & Korean Chamber of Commerce (2016. 3. 16)

The Fourth Industrial Revolution for the discovery of new growth engines for the nation should be developed in a variety of programs for private and corporate participation, and policy research is urgently needed. To that end, this study examines the level of response to the Fourth Industrial Revolution by industry sector and suggests finding policies (financial, advisory, etc.) that can actually help the industry.

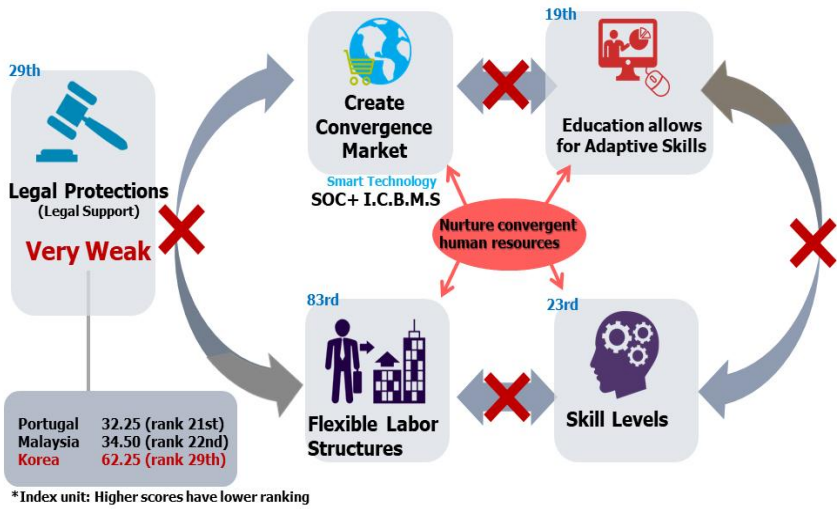
### 3.4 Inadequate adaptation of the converged innovation economy

As we have seen above, Korea is currently experiencing a chain collapse among industries or maladjustment of the converged innovation economy due to a combination of high market entry regulations, lack of R&D, and lack of professional training, passive government policies and lack of legal support. This phenomenon, like the domino phenomenon, is not ending when a particular industry fails to properly respond to the Fourth Industrial Revolution, but creating an impact on neighboring industries and related industries, which in turn creates negative effects on human resources[11] and technology investments.

10) Small and medium-sized companies have a seven-fold gap over large companies ("2016 Survey on Supply and Demand of Industrial Technology", Korea Agency for Industrial Technology Promotion, 2016). In addition, it is impossible for small and medium-sized companies to reduce their risk of short-term immediate effects after investment, which is lacking in investment capacity.

11) The 4th industrial revolution has an impact on the work tasks, the management and the planning system (UweDombrowski and TobiasWagner, 2014).

Figure 5. Fourth-generation industry maladjustment and vicious circle structure




Source: Reconfiguring Kim (2017)

In order to prevent this chain of collapse, i.e., the 4th Industrial Revolution economy, the convergence innovation economy, from being adapted, a drastic policy and consistent investment must be made. It should also be emphasized in this study that the legal support base to ensure this is achieved. This research proposes industrial renaissance strategies that promote overall industrial regeneration by applying intelligent information technology throughout the entire industry, and outlines policy proposals to enhance the responsiveness of the Fourth Industrial Revolution in Korea.

## 4. New growth strategies for the Fourth Industrial Revolution

### 4.1 Technology-based social innovation strategy that uses technology innovation as the driver of social challenges

The Fourth Industrial Revolution is not a subject of a particular field, but an issue of society and economy as a whole, so it is necessary to present a "scientific model of social innovation based on science and technology" to solve social challenges. The basic starting point of the industrial renaissance strategy can be seen as a technological-social innovation strategy that prevents the hollowing out of the national central industrial economy as a result of the deterioration of the traditional industry and gives new values through inter-industrial fusion.

Policy debates should be held to find links between technologies and society that have not been able to correlate with each other through the Fourth Industrial Revolution so that a creative approach can be reached to solve social, economic and industrial problems. Reemphasize the "social-technical system approach" by Geels (2004), which actively uses science technology beyond its value neutrality to solve social problems and, in contrast, emphasizes co-evolution among social-technology technologies.

Figure 6. Public management for 4th Industrial Revolution

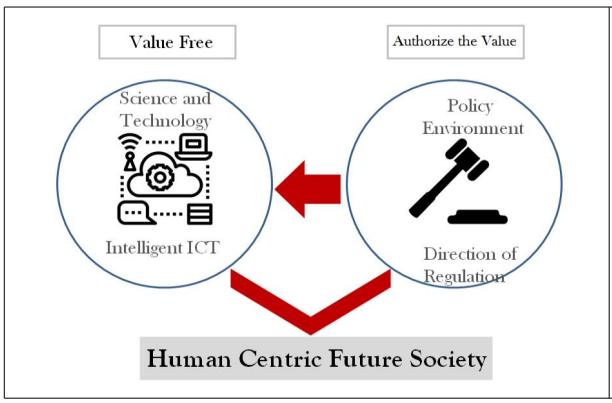
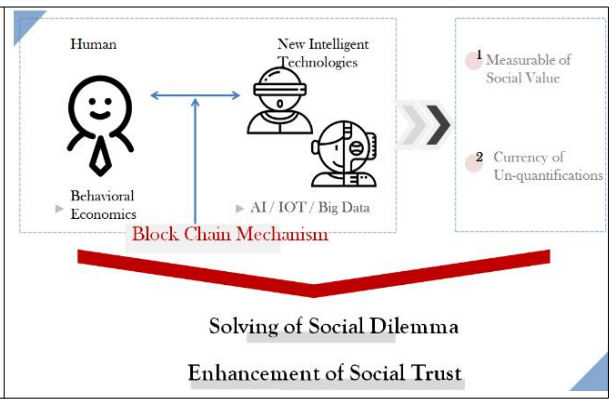



Figure 7. Public management by socio-technical system approach




Source: Reconfiguring Jin and Bang (2018)

To secure the nation's sustainable growth engine, social credibility needs to be strengthened in economic activities and the society where people's lives are made. In the analysis of the Fourth Industrial Revolution, this paper presents human-centered economy and social problem - solving ability as the important core values of the Fourth Industrial Revolution. In order to realize the human-centered economy and social problem-solving power, the government's will and social consensus are needed to use value-neutral technology development as an important resource for solving social problems. As shown in Figure 6, in order to realize society centered on people who are the core of the Fourth Industrial Revolution, it is necessary to grant science and technology a value for solving social problems. Specifically, as shown in Figure 7, we are actively utilizing intelligent information and communication technologies, which have been the core of recent technological innovation, to solve social problems such as building social trust, solving urban problems through smart city implementation, and strengthening social safety. It is a good example that it is being utilized in the whole society.

### 4.2 A strategy for "Industrial Renaissance" in the 4th Industrial Revolution era with the public and private sectors

Productivity innovation and industrial structure can be continued through convergence strategies that integrate intelligent information technology or advanced technology in other fields in traditional priority industries (such as shipbuilding, marine, plant, mechanical facilities and construction) that are losing competitiveness.

Current innovations in all fields of Intelligent Information and Communication Technologies (IICT) lead to huge progress. Among the most important IICT innovations are new driver-technologies like the "Internet of Things, "Internet of Services" or social media[12]. Traditional products and services are becoming ever smarter. The term 'smart' in general implies the attributes - clever, intelligent, agile, modern, and intuitive. Initially, this vertical process of becoming 'smart' addresses mechatronic systems and traditional service systems in a

12) Recent contributions for these new internet developments are provided by combinations of new software (e.g. semantic technologies, big data), hardware components (e.g. smart devices, cloud computing) and communication infrastructure. From the integration of these ICT innovations and the increasing availability of digital contents, disruptive potentials are emerging for all artifacts and products in our real lives (Abramovic et. al., 2015).

separate manner. In an effort to combine mechatronic systems and traditional product systems within holistic concepts, Product Service Systems (PSS) describe the first level of horizontal integration. PSS can be defined as an integrated product and service offerings that deliver value in use. Driven by the current ICT penetration of products and services, new opportunities arise for the horizontal integration into comprehensive smart product service systems (smartPSS). smartPSS are integrated socio-technical Product Service Systems based on networked smart product and smart service systems aiming to fulfill customer needs. Some popular examples are smart cars, smart factories, smart homes, or smart energy grids etc.

In this context, the Ministry of Science and ICT is actively promoting the use of intelligent information technology to expect a renaissance in the industrial sector through the creation of productivity and value-added industries, just as vitamins are needed to enhance the body's biome function. However, it is important to emphasize in this study that several pre-determination issues must be addressed in order to expect this effect. First, consider introducing policies such as regulation free zones, or regulatory sandboxes for regulatory innovation. The government intends to ease or exempt new technologies, products, and services based on convergence technologies from being subject to regulation or postponement. In fact, the current smart start-up technology zone tenant will have to review patent applications, review of bio pharmaceuticals and medical device approval period, grant to local government officials for temporary driving permit, and ease of production and production report system.

However, it should be emphasized in this study that the key to this deregulation policy is the conflict between those who are protected by existing barriers to entry into the market, the existing vested interests of the market and those who are willing to enter new services and technologies. Therefore, it is important to emphasize that strengthening the coordination of consultation and coordination of state administration to manage conflicts among stakeholders is important at the core of deregulation or deregulation in the Fourth Industrial Revolution era.

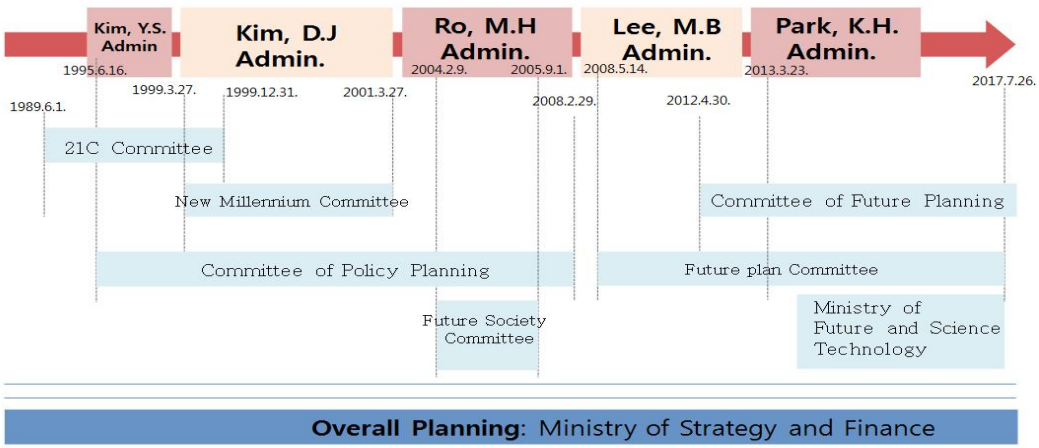
The second element of this study that is emphasized for the Industrial Renaissance in the 4th Industrial Revolution is level diagnosis. The big problem at the moment is that there is no data to accurately convey the importance of the Fourth Industrial Revolution and to understand how much it is responding to and how much it is at. The study pointed out that policy treatments are coming out without a level diagnosis or a status diagnosis. To overcome this problem, we emphasize the necessity of developing the 4th Industrial Revolution level diagnosis model and conducting a survey through it. This is because research can spread the importance of the Fourth Industrial Revolution and its countermeasures to industries and businesses subject to investigation, and develop and implement customized policies by industry through level diagnosis. Through this process, the government can present a roadmap for enhancing capabilities of the Fourth Industrial Revolution by sector and level depending on the results of level diagnosis. In addition, we will present measures to strengthen the capabilities of the Fourth Industrial Revolution according to the response system by level (improvement direction, detailed implementation tasks) and enhance national competitiveness through customized education and consulting.

### 4.3 Platform-type future response system beyond bureaucratic planning

It is important for the government to change the policy framework in order to implement the convergent innovation economy and the industrial renaissance proposed in this study. Also, in order to respond to the 4th industrial revolution mentioned earlier, it is necessary to change the role of the government and the way of operating the government. Among them, this study emphasizes the urgent need to improve the future responsiveness in the administration of the state. The nation's future response was focused on bureaucratic

planning. As shown in the Figure 8, there was a time when a particular administrative department was centralized and economic planning under the planned economic development model was regarded as the whole of future responses.

Figure 8. The History of Korea Government's historical future response organization




Source: Reconfiguring Jin and Bang (2018)

However, in order to comply with the earlier values of the Fourth Industrial Revolution era, the government's inflexibility and regulation-oriented, non-creative state administration are the only ones that cause many problems and inefficiency. Therefore, future responsiveness should be prepared through open operations and open policy-making processes consistent with the time value of the Fourth Industrial Revolution. Also, the subject of future responses should be based not on the bureaucratic administration's arbitrary plan but on the multi-stakeholder collaborative management capabilities. In other words, the government can find ways to restructure industries in the Fourth Industrial Revolution era by establishing a future response system that can grow with open platform[13] operation system that is focused on creating values and solving problems instead of focusing on functions.

## 5. Conclusion

This research has been done in a way that looks at the Fourth Industrial Revolution. In many ways, this study emphasized the importance of borrowing the broadest concept in policymaking by focusing on technology-social innovation and human-centered social orientation, and further emphasized technological-social innovation that actively utilizes technology to solve social and economic problems. Based on this concept of the Fourth Industrial Revolution, it presented the problems facing our economy and industry recently, the lack of responsiveness to the Fourth Industrial Revolution, the lack of an inter-industrial convergence economy, and the lack of ability to respond to government and legislation.

Many of the social problems and policy tasks that appear in the 4th Industrial Revolution process need to

13) Open platform: value-oriented ecosystem including technology, institutions, values, and culture

be solved from a new perspective. In particular, the nation should pursue new growth through social and technical post-catch-up innovation strategies that society, the public and private can cooperate with in the face of limited pursuit strategies based on unbalanced national development strategies. In other words, it is necessary to establish innovative activities and integrated policies to solve future social problems. As unexpected new social problems emerge during the Fourth Industrial Revolution, it is essential that the public management-level social innovation encompasses social issues beyond industrial innovation to enhance competitiveness. While industrial innovation is relatively possible to consider social aspects at least because technology knowledge is practicalized through market mechanisms, social innovation is very important because social innovation solves social problems through market and non-market mechanisms.

A balanced approach is possible to view the technological ripple effect and change as a transition of the entire system in situations where the Fourth Industrial Revolution is not easily predicted. Based on this, the government and businesses are able to see various social problems or environmental destruction that can lead to technological development in advance, and the social innovation that occurs in this case can raise the basic value of our lives beyond simple economic profit creation.

To solve these problems, the research team worked together with the public on the basis of science and technology-based social innovation strategy, which uses the platform-type future response system as the driver for solving social challenges, and the private sector. To implement such policies, the government proposed reform of regulations on barriers to entry into the market by implementing an open platform state administration system through enhanced government coordination. It also highlighted the need to develop a 4th Industrial Revolution response level diagnostic model for diagnosing the level of response to the 4th Industrial Revolution and supporting education consulting to enhance capacity.

This study presents a comprehensive definition of the concept of the Fourth Industrial Revolution, and it is meaningful in that it has derived government changes to improve the level of response to the Fourth Industrial Revolution and the need to level the industrial site.

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