

A Study on Science and Technology Policy Analysis in the field of Construction and Transportation R&D in Korea

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Abstract: The field of construction and transportation R&D has been increased and improved with the integration into the ICT. With the rapid trend changes like the Fourth Industrial Revolution, new direction and solution of R&D policy is being explored to prepare for the convergence era with other diverse research areas. In order to present new direction, it is necessary to analyze the external environment influencing construction and transportation field. In this regard, this study analyzes the science and technology policy plan and goal in Korea. In conclusion, through the policy analysis, this study suggests new direction of construction and transportation R&D in Korea.

Key words: Construction and Transportation R&D, Science and Technology Policy, Fourth Industrial Revolution, Policy Analysis

1. INTRODUCTION

Despite the low growth rate of the global economy, research and development (R&D) investments in major countries such as the U.S., Japan, and China are expanding steadily [1]. The field of construction and transportation R&D investment also has been increased and improved with the integration into the ICT. With the rapid trend changes like the Fourth Industrial Revolution, new direction and solution of R&D policy is being explored to prepare for the convergence era with other diverse research areas. In order to present new direction, it is necessary to analyze the external environment influencing construction and transportation field. External environment analysis describes a framework of macro-environmental factors, and this paper mainly focuses on the technical and political factors for the approach of R&D policy. Thus, this study attempts to suggest new direction of construction and transportation R&D through the policy analysis in Korea.

2. SCIENCE AND TECHNOLOGY TREND ANALYSIS

2.1. Fourth Industry Revolution

In January 2016, the 'Fourth Industry Revolution' term has emerged at the 'World Economic Forum'. The Fourth Industrial Revolution is mainly discussed as 'Industrial Revolution based on fusion of physics, digital and biological technologies' [2]. The Fourth Industrial Revolution has the characteristics of 'Hyper-Connected' and 'Hyper-Intelligence', which means that "everything is interconnected and changed into a more intelligent society". The core technologies such as AI(Artificial Intelligence), Robot, Autonomous Driving Vehicle, 3D Printing, Nanotechnology and Quantum Computing are the driving force of change and the structural reforms of society and economy as a whole. In the era of the Fourth Industrial Revolution, it is expected that the convergence of technologies or the fusion of new technologies will lead rather than an existing single technology. The convergence technology would overcome the limitation of a single technology and create a new market.

Based on the trend of development of convergence technology among diverse technologies, construction and transportation convergence R&D is also actively carried out. With accelerating the hyper-connected society and the normalization of virtual reality, the hyper-intelligence would develop the SOC intelligence and maintenance automation, VR/3D printing utilization, and convergence with IoT/AI technology in the construction and transportation sector. In 2016, in order to prepare for the Fourth Industrial Revolution era, Ministry of Land, Infrastructure, and Transport(MOLIT) announced plans to nurture seven new industries, boosting economic vitality through construction and transportation technology, improving the quality of people's lives, and leading the future [3]. The seven major new industries are Drones, autonomous vehicles, spatial information, desalination of seawater, Zero Energy Building, Smart City, Ritz.

In addition, MOLIT established the task force from January 2017 and has operated it to prepare for the comprehensive strategy of construction and transportation sector. The vision, goal and target set up by the ministry is shown in the figure 1 below [4].

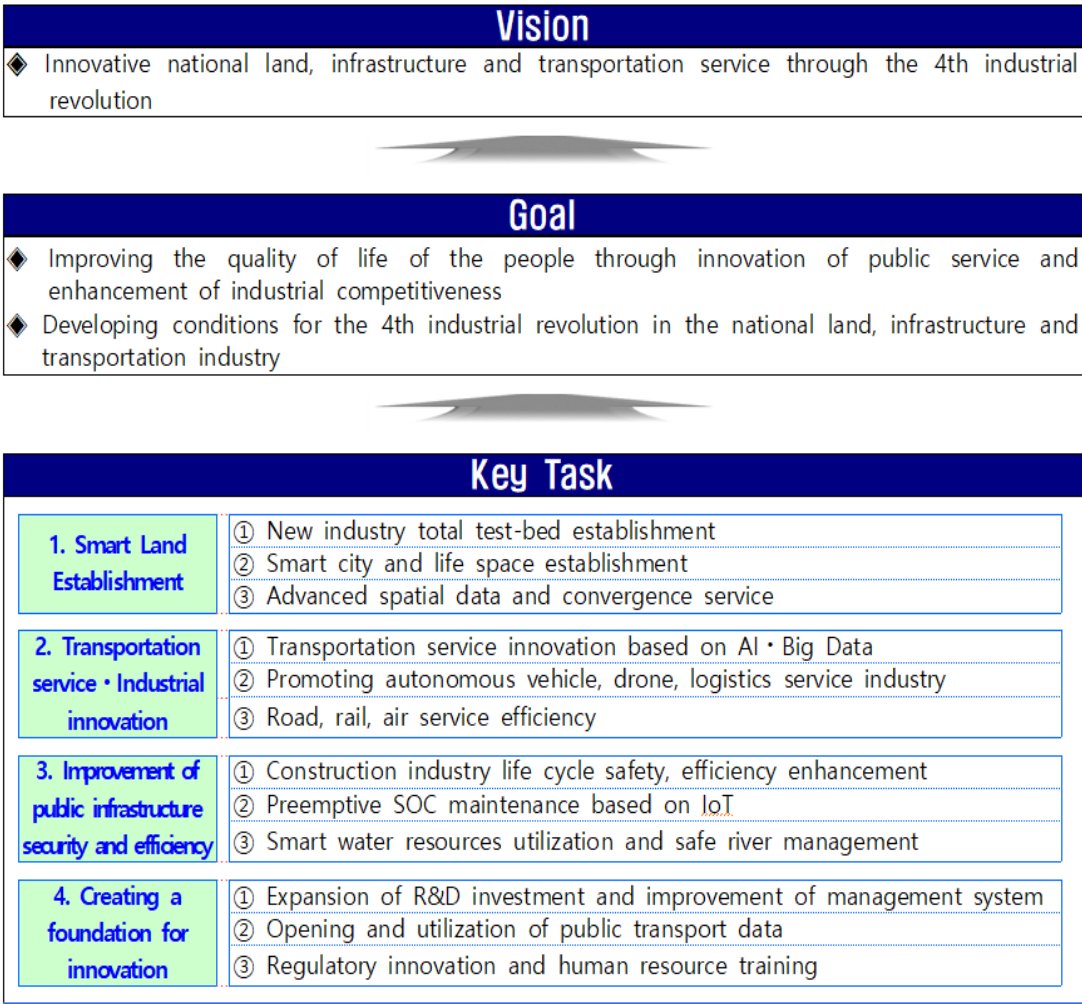


Fig. 1. MOLIT`s the Fourth Industrial Revolution Strategy

With the strategy, MOLIT will visualize the achievements of the construction and transportation industry to make the future economic growth engine based on advanced technologies such as smart construction and traffic data utilization. Through smart transportation technology, they will invest expansion of public transportation service combined with IT and mobile technology to solve traffic congestion and traffic congestion. Also, it is necessary to enhance the development of traffic prediction and safety management services using Big Data to improve the safety of transportation sector and development of technology to prepare for disaster such as earthquake, flood, drought.

2.2. Global Technology Development Patent Status

Patents in the construction and transportation sector in Korea, USA, Japan, Germany, France, UK and China have increased by 2011 [5]. From 2005 to 2014, the number of patent applications related to architectural, urban, SOC, plant, water, and road architectural, urban, SOC, plant, water, and road traffic were filed 294,788 in the nations (Figure 2). Since 2007, China's patent application activity has dramatically increased in all areas of land transportation except for road transportation. Among the seven major countries since 2007, China has the largest number of patent applications. China's patent competitiveness is the lowest among the seven major countries, however it is expected to grow rapidly due to the quantitative research results [5]. The number of patent applications in the four fields of architecture, city, plant and road transportation has increased in Korea. In particular, the patent application activities in the domestic road transportation sector have increased rapidly since 2010.

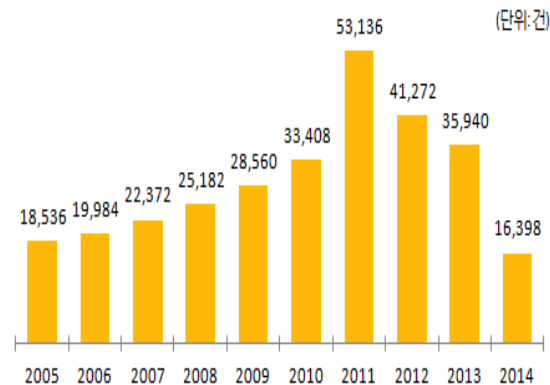


Fig. 2. Patent application status of major seven countries in construction and transportation sector (2005~2014)

3. KOREAN SCIENCE AND TECHNOLOGY PLAN

3.1. National Science and technology plans related to Construction and Transportation

Korean government has maintained policy direction for innovation of construction and transportation technology and enhancement of competitiveness of construction industry through convergence with advanced technology. In order to revitalize the low-growth construction industry, the 5th Basic Plan on Construction Technology Promotion('13~'17) and the 4th Basic Plan on Construction Industry Promotion('13~'17) presents innovative technology and power enhancement plan. Domestic construction competitiveness has mainly focused on hardware-oriented construction field. However, it is emphasized to secure high-value-added technology in order to improve productivity of future construction industry and to establish database through standardization of construction information and emphasize expansion of BIM utilization. The 6th Basic Plan on Construction Technology Promotion('18~'22) and the 5th Basic Plan on Construction Industry Promotion('18~'22) have currently studied by Korea Institute of Civil Engineering and Building Technology(KICT).

In addition, the government established the 3rd Basic Plan on Safety and Maintenance of Facilities ('13~'17) and the Disaster and Safety Management Technology Development Plan('13~'17) in order to secure public safety from the deterioration of the facilities and the abnormal climate, which is converting the facility safety system into a preventive maintenance system based on objective performance and information. Also, the government presented policies on eco-friendly city planning, design, and construction through various comprehensive plans, laws and regulations in the "the 2nd Basic Plan on Building Policy ('16~'20)" and 「Green Building Support Act」 (2012).

MOLIT plans to foster U-city industry as a new growth engine and strengthen R&D to lead in the global market. By fostering and promoting smart city as a new industry, various laws and systems for branding Korean smart cities have been implementing. Korea has actively supported U-City projects in more than 70 cities in 2005, and operated an integrated operation center for services such as Dongtan, Pangyo, and Sejong City. MOLIT expanded and reorganized the existing U-City law to the Smart City Act. The revised 「Smart City Law」 will include support for entry into the overseas smart city market and integrating information systems. Seoul City also announced the 'Smart Seoul 2015' plan and

invested \$750 million until 2015 in the development of wireless internet infrastructure, smart information gap resolution, information security enhancement, CCTV advancement, traffic information service.

In accordance with the 3rd National Transportation Technology Development Plan('14~'18), the transportation technology will be combined with IT, NT, BT, and ET for the development of technology and commercialization. In Korea, the autonomous vehicle definition has been established in the "Automobile Control Act", and standards such as permission for trial operation and provision of temporary operation have been prepared. The system for autonomous driving activation such as autonomous driving test city, called K-City is under construction. According to the National Future Growth Engine Development Plan('14~'20), the 'Smart (autonomous driving) car' was selected as the first strategic business for the advancement of the mainstream industry among the nation's future growth engines. In May 2015 the diverse ministries announced the plan how to commercialize autonomous vehicles through the early establishment of the system and infrastructure.

3.2. New government's science and technology goal

The new Korean government was launched in May 2017 and the 19th President of the Republic of Korea presented a direction for the restructure of the medium and long-term science and technology policy to move away from the approach focused on short-term achievements. The national science and technology plan aims to strengthen autonomy and accountability through the creation of R&D ecosystem.

Korea's Presidential 'The Fourth Industrial Revolution Committee' will be lunched this year in order to establish a unified vision and strategies for whole governance in response to the rapid changes of science and technology. The committee will foster smart house, smart road, smart city of public construction, develop autonomous driving car and artificial intelligence smart highway construction, expand new and renewable energy investment and expansion of zero energy construction, and support for smart factory. In addition, the new government installed the science and technology general department called 'The Office of Science and Technology Innovation' in the new ministry, Ministry of Science and ICT, which is changed from Ministry of Science, ICT and Future Planning. The office aims for the maximization of efficiency and effectiveness in the long-term continuity of policy with strengthened budget authority.

4. CONCLUSION

This study is conducted in order to suggest new direction of construction and transportation R&D through the policy analysis in Korea. For this purpose, the existing national science and technology plans related to construction and transportation R&D and future actions for the Fourth Industrial Revolution in the Korean government were investigated. Based on the abovementioned, The conclusion is summarized as follows.

First, in the Fourth Industrial Revolution, the technology for linking and utilizing intelligent information would be expanded in the construction and transportation R&D. ICT and IoT would strengthen safety management at the construction site and improve productivity and competitiveness throughout the entire construction project. Thus, we need to focus on how to utilize big data from all society.

Second, convergence research with multidisciplinary approaches should be expanded in the construction and transportation R&D. In order to create this environment, the public should consistently collaborate and communicate with diverse stakeholders like academy and industry sectors. Through the collaboration, it is expected to continue to cultivate professional manpower and create new convergence research area for the future.

ACKNOWLEDGEMENTS

This research was supported by "Strategy for leading the future R&D changes for land, infrastructure and transport research" funded by the Korea Institute of Civil Engineering and Building Technology

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