PART II

Construction Innovation in Korea

1. Backgrounds

The construction economy is generally considered to be affected by national macro economic conditions, and explained with business cycle. In Korea, however, there is an argument that recent slackness of the construction economy is mainly due to the limitations of construction demand rather than depression of business cycle.

The approaches to cope with the situation are in two ways. One is to adjust the supply structure of the industry to changes in demand size or demand structure. The other is to create construction demand for drastic socio-economic changes.

Because the construction industry has been accustomed to regulations and depended upon government policies for a long time, restructuring the supply system of the industry is significantly disputable, and may produce some negative side effects in the short term. Thus, it is difficult to execute restructuring without decisive policy methods and reformative institutional frameworks.

The sphere and role of construction should be reconsidered with this changing environment. A new market and opportunities will be opened adjusting to the changing environment. Creating construction demand is possible based on the technological progress. Because the technology is applied to the unprecedented demand, epoch-making technology is required.

Because the environment surrounding us is changing so fast and a significantly high degree of change is required for the construction industry, the speed and pattern of the change should also be changed. What the construction industry needs under this situation is ‘innovation’. In this study, construction innovation is discussed in two ways: one is innovation at the government level, the other is innovation at the private level.

2. Government Level Innovation

Three types of efforts of the Korean government to innovate the construction industry are introduced in this chapter. First, regulatory reform is evaluated as a policy innovation. Second, investment in R&D is also discussed in the context of technological innovation. Lastly, informationizing construction administration is regarded as an important methodological change to regulate the industry.

2.1 Regulatory Reform

The regulation on the construction industry has been justified, because the industry is closely related to public life and imperfect competition may rise due to its complex industrial organization. However, sometimes, the regulation to correct imperfect competition hinders rather than promotes the market competition and causes inefficiencies of the supply system of the industry.

The most representative example was the limitation on the business scope. The nation is presently enforcing a registration system for contractors in the construction business. Each business is classified into one of two categories, "General" and "Specialty" construction business. The "General Contractor" is classified into 5 types of works such as civil engineering, building, civil engineering and building, industrial facilities and landscaping. And the "Specialty Contractor" is classified into 29 types of different trades such as interior design, earthworks, boring & grouting, etc.

A general constructor who is allowed to carry out a comprehensive contract for construction work should not carry out a specific type of construction work which is allowed to a specialty constructor usually under subcontract with the general contractor.

Under the regulation limiting the business scope, even small construction works which may be carried out by the general contractor only should be carried out by both general and specialty contractors to increase costs and inefficiencies. The regulation also limits the discretion authority of the construction works ordering organization. In addition, the regulation has become null because contractors on both sides participate in the other market through various tactful ways to establish many paper companies.

Recognizing the problems of the limiting regulation on business scope, the government amended the Framework Act on the Construction Industry in May, 2007 and is preparing the subordinate ordinances. Through amendment of the Act, the limitation will be abolished. The complementary measures to follow the amendment and relax the shocks of the policy to small and medium companies also will be provided.
That is, the evaluation system for construction capability, the specified classification system for the construction business, and the registration criteria for the construction business will be rearranged so that both the general constructors and specialty constructors may participate in construction projects over a certain volume.

2.2 Investment in New Construction Technology

Recognizing that the national competitiveness of the technology in construction and transportation was lower than the global standard, the Korean government established the goal of construction and transportation in the future as ‘Value Creator’ from the role of simple ‘Growth Supporter’. Specified objectives are; accomplishing the construction technological standards with a ranking within the 7th in the world before 2015, reducing construction costs by 10%, reducing the costs related to transportation and disaster, occupying 10% share of the foreign construction market, reducing traffic accidents by 10%, and inventing 5 best technologies in the world.

To accomplish the goals, the government has continuously expanded the budget for research and development in construction and transportation. Reflecting the social and economic demands in the future, 10 projects were chosen as value creators. They are U-Eco City, Ultra High Rise Complex Functioning Building System, Cubic Urban Renovation System, Intelligent National Land Information Technological Innovation, Safe Sustainable Smart Highway System, Ultra Long Bridge, Future Type High Speed Railway System, Urban Magnetic lev System, Desalting System of Sea Water, and Small Air Plane Technology.

As shown in <table 1>, the government has continuously increased the ratio of the budget for research and development to the total government budget. During the period, 2006~2015, the government will invest 6.5 trillion won (7.1 billion won) in research and development for the technologies for construction, high technological city development, future type railway system, et cetera, as in table 2.

<table 2.2> R&D Investment compared with the total MOCT Budget

Classification	2002	2003	2004	2005	2006	2007
MOCT budget (a)	15,244	17,228	16,327	18,090	17,389	*16,674
R&D budget (b)	46	69	75	152	262	328
B / a	0.30	0.40	0.46	0.84	1.51	1.97

* : not determined (billion won, %)

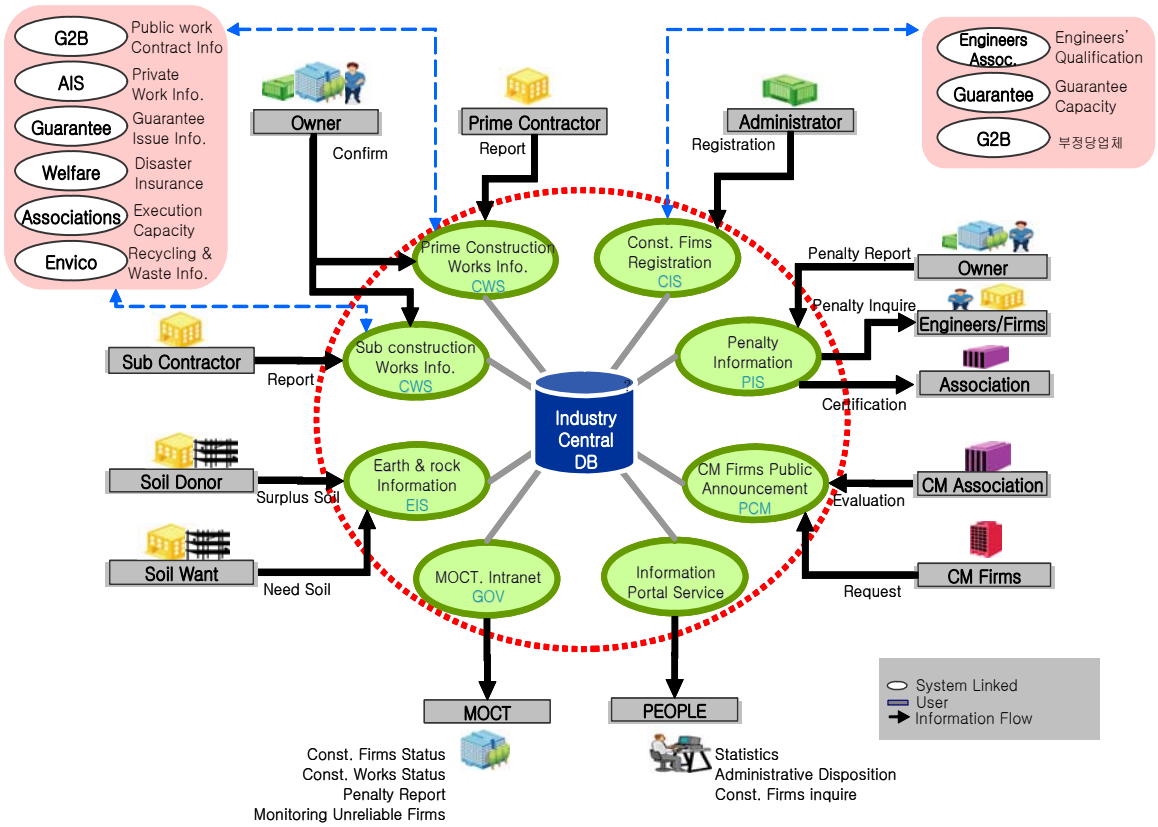
<table 2.3> Estimated investment in R&D during 2006~2015 (trillion won)

Project for construction technology innovation	1.0	Developing future type railway system	2.2
Upgrading plant technology	0.39	Advancement for the logistics system by aviation and ground transportation	0.67
Development project for high technological cities	1.48	Supporting man power for technological infrastructure	0.24
Project for transportation system efficiency	0.7		

The investment of 6.5 trillion won in R&D for 10 years is expected to generate economic effects of 110 ~ 150 trillion won (150 ~ 163 billion dollars) through reduction in direct and indirect costs and development of related industries. In addition to budget increase, the government restructured the project implementation system from the department type system to the big project implementation system. The management method was also changed into the performance oriented project manager system.

2.3 Innovation by Construction Information System

Forecasting the 21st century will be the knowledge and information based society, the Korean government established the information management system that can be total information control on the construction industry. Using this information system, named KISCON, the Ministry of Construction and Transportation (MOCT) can obtain more effective and reasonable governance. The basic strategy of this KISCON is obtaining the industry information at a low cost while making the administration for the industry transparent. Based on the ‘Framework Act on the Construction Industry’, MOCT has developed their information managing solution of the construction industry under two major directions. One is managing admission to the construction market to be a construction firm. The other is managing the activities in the construction market of construction firms. The system for the former is called Construction Industry administration System (CIS), the system for the latter is called Construction Works information System (CWS). To this infrastructure, MOCT has been adding such as Penalty Information System for inadequate construction work (PIS), Public-announcing of Construction management firm (PCM), a monitoring and inquiring system for MOCT (GOV), Earth and rock Information System (EIS), and information portal system of the construction industry for people (KISCON).



Now, MOCT has governance from these systems electronically, which are currently controlling 70,000 construction firms on their admission to the construction market and monitoring their activity in the market, only costing 1 million US dollars a year. The overall economic effect is reaching over 80 million US dollars.

3. Company Level Innovation

3.1. Competition for Excellent Innovation Practices by Construction Companies

Construction innovation may be realized through the efforts from individual companies to change and survive. The Korean Federation of Construction Industry Societies (KFCIS) opened 'the Competition for Excellent Innovation Practices by Construction Companies' since 2006. The competition may show the situation and trend of the activities for construction innovation at the private level.

There are four groups of different types of innovation; innovation for co-operation between construction companies, innovation for business administration, technological innovation, and innovation for customer satisfaction. Innovation for co-operation is demanded because the Korean construction industry has been bipolarized between big companies and small companies, contractors and subcontractors, capital area companies and local companies, et cetera. To reduce the costs and improve the efficiencies necessary to survive under the situation of the Korean construction industry, innovation for business administration is required. To meet and create the new demand for the construction industry, technological innovation should be based on. Finally, innovation for customer satisfaction is added because construction ignoring customer's demands may no longer survive.

Through the two competition events during 2006-2007, 27 cases in 2006 and 29 cases in 2007 were submitted. The submitted cases can be classified as in <table 3>. Among those cases submitted from the large or small construction companies, 12 cases in 2006 and 8 cases in 2007 were chosen as excellent cases. The selected cases are presented in <table 4>, and the best case each year is briefly introduced in the following section.

<table 3.1a> Number of Cases (Companies) of Submission in Competition

classification		total	business administration	technological innovation	co-operation	customer satisfaction
# of cases (companies)	2006	27(17)	4(3)	19(15)	2(2)	2(2)
	2007	29(12)	8(4)	12(8)	5(5)	4(4)

<table 3.1b> Excellent Cases Selected in Competitions in 2006~2007

2006

Classification	Type	Company	Title
Grand Prize	Co-operation	Lotte construction	Establishing co-operation system through innovation of procuring process
Golden Prize	Business administration	Samsung construction	Innovation of high rise construction management using RFID and 4D-CAD
	Co-operation	Hyundai construction	Successful case for accompanied foreign construction project
Silver Prize	Technology	GS construction	A new productivity improvement in the pier coping construction with pre-assembled reinforcement arrangement
	Technology	Saman industry	Technology for ark gate
	Business administration	Posco construction	Reducing construction period through 3 day skeleton cycle per story

Bronze Prize	Customer satisfaction	Daerim industry	Obtaining opinions and ideas from house wives
	Customer satisfaction	Sinkwang fence construction	Development and construction of environment and residents friendly soundproofing tunnel
	Technology	Lotte construction	Practical use for 120Mpa hyper strength concrete
	Technology	Hyundai construction	Developing WJCS (welding joint control system)
Encouraging Prize	Business administration	Daewoo construction	Construction site innovation utilizing IT technologies
	Technology	Korea ABM construction	Manufacturing and installing technologies for complex arch panel

2007

Classification	Type	Company	Title
Grand Prize	Business administration	Samsung construction	Performing the best high rise building technologies through 3 day skeleton cycle per story
Golden Prize	Technology	GS construction	A new productivity improvement in the M.S.S method with pier bracket self moving system
Silver Prize	Co-operation	Dongbu construction	Construction productivity improvement through construction site innovation from the view of a co-operation company
	Customer satisfaction	Samsung construction	Establishing prosumer system for service innovation for apartment residents
	Technology	Posco construction	Practical use of concrete outrigger for high rise construction
Bronze Prize	Technology	Jaehyun construction	Jacket installing technologies for construction on water-using barge boat
	Business administration	Lotte construction	System for efficiency improvement for a large volume of map information and labor management
	Customer satisfaction	Daerim industry	Innovation for customer satisfaction of e-convenient world

3.2. Selected Cases

3.2.1 Establishing a co-operation system through innovation of procuring process : by Lotte Construction corp. (grand prize in 2006)

This case focused on the procuring process which occupies 70~80% of the construction costs. The case is classified as a innovation for co-operation because the procuring process is based on the co-operation system between contractors and sub-contractors.

The company organized the innovation task force team in 2001. Different from the electronic purchasing system of manufacturing companies which is operating for saving costs and time, the company standardized the procuring process operated with the subjective decisions for improving transparency.

In the registration process for co-operating companies, a one-stop electronic procuring system including on-line construction site presentation, electronic bidding, electronic contract, electronic tax calculation sheet issuance was established. In 2005, the whole procuring processes like developing the standard module for electronic certificate were innovated.

As a result of the procuring system innovation, 8 billion won (8.6 million dollars) of construction costs from the Lotte construction company and co-operating companies were saved. 85% of Lotte employees and 90% of co-operating companies showed their satisfaction in the survey for satisfaction with innovation. In addition, the time for each procuring case was saved from 400 minutes before innovation to 180 minutes after innovation.

3.2.2 Performing the best high rise building technologies through 3 day skeleton cycle per story: by Samsung Construction corp. (grand prize in 2007)

This case focused on method of construction from technical experience of high rise building construction. The company has an experience of three highest buildings out of world top five high-rise buildings such as Petronas Twin Tower in Malaysia, TFC 101 Tower in Taiwan, Burj Dubai Tower in UAE.
From these exceptional experiences, the company developed innovative 3day skeleton cycle per story for the SRC structured high rise building. This technical innovation was based on rational zonning, construction management standardization, system form applying, 3story advance fabrication, and early-strength high performance concrete.

Nowadays, major high rise buildings have the SRC (steel reinforced concrete) structure for their skeleton, and generally this structure takes 45% period of the total construction period. So the period reduction in structure construction is essential in overall construction period reduction.
As a result of the technical innovation, the construction period for a 30 story building has reduced by more than 1 month which is top working day in the world while world class average W/D(working day) per story is 4.6W/D

4. Conclusion

In the past five years, innovation has been the subject of discussion so often everywhere in Korean society. Construction innovation has made visible innovative efforts which the current age requires for the construction industry. Because the innovation activities have not been initiated based on technological innovation during the same period, the innovation was demand-led rather than supply-pushed. Although there have been enormous efforts to respond to this demand due to the social change, it is still questionable that those activities involved the discernable change or challenge of the status quo which was mentioned by West and Farr (1991).[1] Most of the efforts titled ‘innovation’ were not much different from what the government or construction company did before. Innovation should be beyond the simple extension of a normal change.

Innovative reform of construction regulations seems to be limited in nature, because the construction industry deals with public goods such as infrastructure, merit goods such as houses, and others which have external economies. Because the construction industry is based on the contract-subcontract relation among companies and is still intensive with labor, the pure market competition would seriously blow small and medium companies, in turn, employment of the industry would be negatively affected. In addition, ‘price’ has been replaced by ‘value’ as a key parameter of a more advanced construction market especially in the bidding system. In these senses, the regulatory reform of the construction industry no longer means the orientation towards market mechanism.

[1] See *Innovation and Creativity at Work: Psychological and Organizational Strategies* by Michael A. West and James L. Farr, John Wiley and Sons Ltd.: New ed. (1991)

Private creativity is the most important factor in technological innovation. The effect of research and development investment, however, will appear on the national economy in the long term, while it requires huge budget. The investment is very risky and not directly responsive to private companies, it is limited for private companies to assume R&D investment.

The construction Information System shows how innovation in information and telecommunication changed construction administration. The system increased efficiency and effectiveness of construction regulations and improved transparency of construction administration.

For innovation to spread to the whole construction industry and be vitalized, innovation should be leaded by private companies. Although it is not enough to evaluate the innovation at the private company level through the two innovation competitions, it may show some tendencies about innovation of the construction industry. The competitions resulted in several successes in inducing various types of innovation such as co-operation, business administration, technological innovation, and customer satisfaction by both big and small companies. The competitions, however, did not show private energy for innovation, and still innovation seemed to be recognized as a technological matter.

Construction innovation is on going in Korea. No matter what it is correspondent to what ‘innovation’ originally means, the important thing is if these efforts would actually change the construction industry which is in crisis.