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## Research on Barriers and Government Driving Force in Technological Innovation of Architecture Based on BIM

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### ABSTRACT

Technological innovation and knowledge transfer are a complex process, facing the challenges of various obstacles, may be the impact of technology, organizational, economic or talent, which requires innovation within the main and external power drive. BIM is gradually applied to the entire construction industry chain, in which the implementation of 3D modeling design application has been deeply rooted, stakeholders gradually accepted the BIM throughout the construction project life cycle development concept. Nine percent of stakeholders believe that BIM implementation is important. In the process of technological innovation and knowledge transfer, the priority of BIM implementation is focused on three aspects: cost, standard and talent. The choice of government driving force is focused on three aspects: fiscal and taxation support, national standard and education and training.

**Keywords:** architecture, technological innovation, building information modelling, government driving force

### INTRODUCTION

The knowledge of technological innovation needs to be widely used. Due to the hidden characteristics of knowledge innovation, the absorptive capacity of the recipient and the multiple states of the external environment directly or indirectly affect the technological innovation and knowledge transfer, inevitably encounter obstacles such as law, organization, standards, cost and talent and so on (Turk, Z., 2016). At the same time, technological innovation and knowledge transfer not only need the research and development and application of enterprises, but also related to industries, education and government.

BIM is one of the most significant technological advances in the construction industry. It is the basis of the relevant information and data of the construction project. Through the establishment of the three-dimensional building model, the integrated digital information simulation simulates the real information of the project. Through the establishment of the three-dimensional building model, the building with visualization, coordination, optimization and feasibility five characteristics. BIM promote the construction industry from the project approval to the construction, maintenance of the whole life cycle of information exchange and sharing. BIM's mission is to organize people and information effectively together, providing design, construction and maintenance as a complete and rich model that provides technical support for the construction industry and technical processes to help owners improve design and improve construction and maintenance efficiency, reduce construction costs,

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#### **State of the literature**

- Technological innovation and knowledge transfer are more and more attention by the international community and have developed into a new discipline in recent years. The results are mainly on the technical innovation and knowledge transfer of the main factors, knowledge transfer evaluation principles and methods of research.
- Chinese scholars have explored basic research, but the study of construction industry is still weak. Foreign scholars focus on the external environment of the main body of technological innovation to study the problems related to the dynamic model of technological innovation, such as the early technology promotion model, the market demand pull mode and the technology promotion - the market demand pull the comprehensive model (Chong, H.-Y., 2016).
- The combination of the external environment of the innovation subject and the internal environment, and the driving force of the common action on the promotion and pulling of the innovation subject cannot be studied deeply (Grunewald, J., 2016). Especially on the government driving force in the process of technological innovation and knowledge transfer important role in the study is obviously inadequate (Cao, D., 2016).

#### **Contribution of this paper to the literature**

- Seeking technical innovation and knowledge transfer in the process of obstacles in common.
- Completing the knowledge transfer and BIM implementation process of the main obstacles between the model; through literature mining and data analysis.
- Seeking the government in the technology Innovation and knowledge transfer in the role of government and its common ground and building a technical innovation and knowledge transfer application effect (BIM as an example) and the relationship between the government driving force model.

reduce waste in the construction process and reduce carbon emissions. The focus is on “performance” and “efficiency”. The study found that the construction industry’s economic benefits can be increased by 6% to 16% through the use of BIM technology. BIM is introduced into education, which can significantly improve the competitiveness of students in the future job market. BIM’s scope of application and the number of enterprises are also increasing year by year (Skandhakumar, N, 2016).

## TECHNOLOGY INNOVATION

China’s research on technological innovation began in the 1990s, and the influential research expert in the field of technological innovation, technological innovation must first have a strong theoretical basis, followed by a way to help promote Chinese socialism Market Economy Development and Enterprise Reform. In other words, entrepreneurs to seize the potential market opportunities for profit, access to commercial interests as the goal, to re-organize production conditions and elements, to build a more efficient, more efficient and lower cost of production and management system, the implementation of new products, New production processes (methods), opening up new user markets, acquiring new raw materials or semi-finished product supply sources, or building a new organization of enterprises, including organizations, technology, business and finance. Technological innovation is the development and change of productive forces. That is, “the application of new technology in production”, in the production of new technology to replace the old technology, and to the market, is a cycle, and gradually improve the process. The meaning of technological innovation, is the innovative technology of new ideas, through research and development or implementation of technology portfolio, applied to products and processes, and produce economic and social benefits of the whole process of commercial activities (Ghaffarianhoseini, A., 2016).

In the “Decision on Strengthening the Development of Technological Innovation to Promote the Industrialization of Science and Technology”, the CPC Central Committee and the State Council pointed out that technological innovation is a way for enterprises to apply innovative knowledge and innovative technology, innovative technology, innovative production mode and management mode. Improve product quality, development and production, through new products, new services to meet the market and achieve market value.

Different industries stand different state, the definition of technological innovation will be slightly different. Science and technology scholars pay more attention to technological innovation brought about by the scientific and technological progress to give social entity productivity, such as the construction industry to use commercial equipment to reduce labor and improve labor efficiency; economists value of technological innovation on social and economic development of the driving force; In the technological innovation on the formation of enterprise products and business operations generated profits. In short, technological innovation is the whole process of new products and new processes from creativity, deduction, design, implementation and results. It is the process of forming new products and other achievements after new technology and new technology intervention. The market repeated tests to achieve the survival of the fittest.

Technology-driven model refers to the technological innovation that is formed by the promotion of technological development. Its performance is driven by significant discoveries by science and technology, driving technological innovation activities, creating new demands for the market, or stimulating potential market demand. Its advocate is the founder of technological innovation theory Joseph. He emphasized that the needs of technological innovation not produced by the market, but by the Innovation subjects with technology patents according to the functional applicability of technology to Innovate, so as to meet the demand of the market or to create and guide new demand.

The potential and direction of market development are the main determinants of the speed and direction of technological innovation activities. After, the scholars stressed that technological innovation from the market demand. Market demand information is the starting point for technological innovation activities, it makes clear requirements for product and technology. Demand pull can lead to 60% - 80% of the important innovation because of this model over-emphasis on social needs and production needs, while ignoring the leading role of scientific research, the same one-sided.

The combination of technology to promote mode and the market pull mode, also known as the dual power mode. Dual model active advocate Rosenberg. Companies should find the technical possibilities, that is, technical support, but also to actively determine whether the market opportunities, that is, market demand support. The weight of technological innovation activities is also the cooperation and coordination of the two, but also the support of both forces under the combined effect of mutual dependence and interaction results. The dual model takes into account the combined effect of technology promotion and market pulling, but there is also the neglect of the role of innovation (organization / individual) itself, and there is still one-sidedness (Bae, A., Lee, D., & Park, B.-Y., 2015).

## KNOWLEDGE TRANSFERRING

Knowledge transferring is a research focus in the construction industry. The goal is to accelerate the integration of knowledge among stakeholders, make better use of integrated knowledge, and promote high-quality output in the construction industry to achieve optimal use of time, cost and quality portfolio objectives. The core of information networks and knowledge transfer is considered to be an industry strategy to improve overall productivity. Technological innovation is closely related to knowledge transfer. In the past, the academic research was more about the diffusion of technology. It was generally accepted that technological diffusion was the process of innovation and technology was adopted by other enterprises through legal means only by realizing the technology diffusion and the potential utility of technological innovation can be played. Knowledge innovation as "transforming new ideas into sellable products and services through creation, evolution, communication and application", and knowledge transfer is the new ideas through legal means to other enterprises to transfer. In a certain context, knowledge transfer is from the source of knowledge to the receiving unit of the information dissemination process. It also has a cross-organizational boundary or within the organization of purposeful, planned knowledge sharing, in different ways in different organizations or individuals to achieve knowledge transfer and dissemination.

The ability of knowledge transfer is an important support for business survival. Through the transfer of knowledge, the absorption of new knowledge and the effective use of new knowledge, will enable the organization

to benefit the knowledge to accelerate the application, so that the organization has a competitive advantage, is the purpose of enterprise knowledge transfer, to enhance the competitiveness of enterprises is essential. The case proves that organizations that effectively achieve knowledge transfer within the organization are more productive and viable than those that cannot be effectively implemented. Only companies that continue to create new knowledge, effectively transfer new knowledge, and quickly develop new technologies and new products can succeed.

Successful knowledge transfer is an important process that needs to be continually improved in a knowledge-intensive economy today. However, the complexity of obtaining, assembling and sharing knowledge for building practitioners is a hallmark of the challenge of improving the process of knowledge transfer for building practitioners. When mastering key success factors will improve the process of knowledge transfer. In a rapidly changing knowledge-intensive business environment, organizational knowledge becomes an important resource and an important determinant of business success. Thus, knowledge transfer can be described as a process of change in the knowledge or skills involved in moving from entities with a professional knowledge, such as individuals, groups and organizations to another entity, or from one place to another. The successful knowledge transfer is the result of a change that causes the receiving entity to absorb and apply the accumulated new knowledge.

### INFORMATION TRANSFERRING

The construction industry has been reborn in the past two decades. The BIM concept has been modeled from 3D modeling to 4D programming in close connection with the construction process, a 5D model integrated with cost data, and even ND modeling. It is widely believed that BIM can play an important role in the integration of the entire life cycle of the project. The first climax of BIM's promotion in the construction industry began in the mid-1990s as a way to overcome the low construction efficiency and other obstacles that hindered innovation in the industry. BIM technology makes the entire design and construction process more simplified and versatile, resulting in a series of direct and indirect benefits. It is estimated that BIM can eliminate the 40% of the unpaid budget, which can reduce project completion time by 7% and 80% of the time cost. BIM applications can be integrated with design, construction, maintenance and removal, build a rich data model, and help stakeholders improve performance and efficiency, reduce costs, risks, waste and carbon emissions. BIM provides a practical solution for reducing carbon emissions for technological innovation to promote the design, construction and operation of sustainable buildings. BIM technology has also led to improvements in the labor market, encouraging more collaborative work, and improving communication between people in the project. As a result, the Building Information Model (BIM), as a multidimensional modeling technology for the construction industry to promote information exchange, is highly concerned by global construction engineers (Hui Shen, 2015).

### BARRIERS TO BIM IMPLEMENTATION

With the opening of China's construction market is getting higher and higher, the international construction market to accelerate the globalization of domestic and international construction market competition is more and more intense, the domestic construction industry and international construction giants competition is inevitable. And the construction industry's technological innovation is the inevitable of this competition. The competition will also reflect the gap between technological innovation between countries and enterprises, enterprises and enterprises. It also reflects the knowledge and attitudes of knowledge transfer, the communication of knowledge transfer process, the skills of mastering, the international reputation and the significance of organization. It is necessary to combine new and old knowledge into resources to gain a competitive advantage beyond the market. The effective management of knowledge is a major challenge facing the organization. Taking into account the essential process of knowledge management is the transmission of knowledge between individuals and organizations. Knowledge transfer between individuals and organizations is seen as a key process in the nature of knowledge management. A successful transfer of knowledge can lead to the organization of intellectual capital and the improvement of resources (Bianco, M., Koss, R., Zischka, K., 2016).

Due to the complexity of knowledge and the process of knowledge transfer involved and numerous mechanisms, its successful transfer is often not easy to achieve. A successful knowledge transfer will provide innovative ideas that can be applied to follow-up projects. Knowledge transfer is costly, depending on the degree to which knowledge itself is transmitted, interpreted and absorbed (Qiu, J., 2016).

### PROMOTING THE IMPLEMENTATION OF BIM IS NECESSARY

The Building Information Model (BIM) effectively organizes the right people and information together to support certain processes and technologies. By building a 3D database of building products that includes a wealth of data and information structure. It is applied to the analysis of architectural performance, sustainable development throughout the entire life cycle of the building. BIM from 3D modeling to 4D programming in close contact with the construction process, integrated with cost data 5D models, and even sites) to help BIM stakeholders achieve product performance and efficiency improvements, reduce costs, risks, waste and carbon emission. It can lead to the improvement of the labor market, the increasing of collaborative work, and improvement of the communication between people. BIM facilitates a simpler and multifaceted transparency in the overall design and construction process, resulting in a series of direct and indirect benefits. BIM as the advanced technology of contemporary construction industry, and is gradually applied to the entire industry chain. The survey results show that the implementation of the design phase based on 3D modeling for the core is already deep. Construction stakeholders have not only gradually accepted BIM, and are absorbing and integrating project cost, project management, and application development projects throughout the life cycle of the concept of development. Based on stakeholder feedback, the necessity of implementing BIM in the construction industry is fully recognized and widely concerned.

### THE PREFERRED BARRIERS

In the preceding article, the literature lists the barriers to technological innovation and knowledge transfer and BIM implementation. In the case of the implementation process alone, the obstacles are concentrated in terms of cost, standards and talent. The most prominent obstacle to BIM implementation is the high cost of management (software), the lack of BIM national standards, and the lack of BIM skills. The results of the survey also proved this judgment, respectively, more than 70%, 68% and 60% of the stakeholders on the recognition. From the view of technology, the country proposes BIM standardization, to unify the construction behavior, to promote the construction industry information exchange and standardization of operations (Xiao, L., 2016). From the perspective of promoting the independent innovation capability of the construction industry, the state implements the BIM standard, can build its own BIM technology system, break through the international technical barriers, and rely on foreign technology. Encouraging the construction industry to work closely with the software industry will also result in a significant reduction in the initial cost of the BIM implementation process. From the construction industry labors ability, the application of advanced technology requires excellent professionals to complete, pay attention to the introduction and training of BIM technical personnel is the key to the success of BIM implementation. Therefore, the hypothesis of this study: cost, standards and talent is the preferred level of BIM implementation is also established. Technological innovation is the result of the combination of several inventions, capital investment, establishment of organization, planning, recruitment of employees and market development. For the construction industry, technological innovation to create new construction technology, and within the enterprise and the project between the spread of technology, can form a new architectural technology innovation organizational structure and organizational culture elements. Thus, through the BIM implementation of the obstacles and their preferred level of research, we recognize that in the process of knowledge transfer, BIM implementation of stakeholders will encounter many obstacles, and these barriers are mutually influential. Identifying the relationship between these obstacles is of great significance to overcoming the difficulties in the process of knowledge transfer. To this end, taking the implementation of this study as an example, the relationship between the main obstacles in the process of knowledge transfer (taking BIM) is established. For example, if the organization of knowledge transfer cannot adapt to the implementation of innovative technology, it will inevitably lead to the increase in the cost of knowledge transfer, the formation of organizational entities operating efficiency barriers (Peng, L., 2016).

## THE MAIN MANIFESTATIONS OF GOVERNMENT DRIVERS

The government can directly or indirectly play the role of technological innovation and knowledge transfer project, the risk of financial institutions, the interests of regulators, cooperation promoters and other roles, deployment and promotion of process standards development and process monitoring. The government not also as an investor, through the export of capital to promote the development and diffusion of technical research, but also as a sponsor to raise basic research and private R & D funds to promote technology research and development. The implementation of a new technology must also involve industry and education. The government's role in these areas decided the success or failure of the technological innovation and knowledge transfer. Powerful government drivers are key initiatives to develop and deploy complex technology systems. Information support mainly for the government to promote, policy guidance, the development of standards and other measures to improve the industry stakeholders know, select and use the new technology capacity. Financial support is reflected in the government to develop financial subsidies, tax relief, loan guarantees and other preferential measures and support policies to encourage industrial technology innovation and knowledge transfer. Talent support is the performance of the government to mobilize educational resources for the industry to provide technical innovation and knowledge transfer process of professional skills and training. These are the main ways in which the government expresses the incentives for technological innovation and knowledge transfer (Padegimas, E. M., 2016).

There is no doubt that the government has a driving force. So, what is the size of the government's driving force, or what is the relevance of the effectiveness of government policy enforcement and technological innovation and knowledge transfer? This is of great significance for the government to introduce different policies in different periods of knowledge transfer in the construction industry. To this end, the implementation of this study, for example, the establishment of the government driving force and BIM stakeholders the effect of the implementation of the model.

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