

BIM-Based Project Management Process Re-engineering Research

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Abstract: At present, China is in an era of rapid economic development. Building information modeling (BIM technology) as an emerging technology in China continues to develop, and related theoretical works are increasing. At the same time, project management is also the fundamental guarantee for the success of building construction projects. Hence, the combination of BIM and project management is the general trend in the development of the construction industry. This paper will study the development history of BIM technology and process reengineering theory, the problems of BIM technology development in China at this stage, and the necessity of project management process reengineering to be carried out.

Keywords BIM Technology, Process Re-engineering theory, Project Management

INTRODUCTION

Although BIM technology is developing in China's construction industry, the level of BIM technology application in actual construction enterprise project management could be much higher at this stage. The implementation effect is not good because when introducing BIM technology, enterprises implement a "dual-track system," i.e., ordinary engineering project management and BIM technology are separated and do not interfere. The reason is that when enterprises introduce BIM technology, they implement a "dual system"; that is, ordinary engineering project management and BIM technology are separated and do not interfere with each other, and do not adjust the existing project management mode and process according to the characteristics of BIM technology, and the value of BIM technology is not fully demonstrated. Therefore, the main reason for the poor application of BIM technology in China's construction industry project management is the lack of a project management process based on the BIM environment, so building construction enterprises urgently need a clear set of project management processes based on BIM technology.

RELATED THEORETICAL CONCEPTS

Building Information Model

BIM Concept

BIM (Building Information Modeling), or Building Information Modeling, is a concept that originated in the United States in the 1970s and was introduced by Dr. Chuck Eastman of Georgia Tech. He defined BIM as Building Information Modeling, which is the integration of all geometric nonlinearities, functionality, and performance of components of a

building project throughout its life cycle into a single model.

Features of BIM

During the development of BIM technology, it always has the following advantageous features.

(1) BIM technology can build a three-dimensional model, thus breaking through the limitations of flat design drawings.

(2) It can facilitate communication between the construction participants and help the owner to save on the high cost of building rework.

(3) It can simulate the whole construction process and even make emergency rescue simulations for natural disasters to improve the success rate of construction.

PROCESS RE-ENGINEERING THEORY

Process Re-engineering Concept

The theory of Business Process Reengineering (BPR), which first originated in the 1990s, was based on the problems of enterprise process management in the U.S. Michael Hammer, an American management scholar, proposed the concept of business process reengineering, arguing that: "Enterprise business process reengineering is to business process to do fundamental thinking and thorough redesign, so that the enterprise can obtain great improvement in cost, quality, service, and speed, and can adapt to the modern business environment characterized by customers, competition and changes to the maximum extent." Process reengineering refers to systematically and dialectically optimizing and improving the operation mode and structure of existing processes and operations to propose and create more effective and rational management processes.

2.2 Process Re-engineering Procedures

- (1) Decision-making stage.
- (2) Enterprise research phase to understand the operation of existing processes.
- (3) Identify core processes and the selection stage of processes to be re-engineered.
- (4) Process judgment analysis stage to find the root problem of the existing process.
- (5) The process re-engineering design phase, where processes are designed to fit the project itself based on the underlying issues and the core processes.
- (6) Operation of the new process and continuous improvement.

REVIEW OF DOMESTIC AND INTERNATIONAL RESEARCH

Status of Foreign Research

BIM Technology

BIM technology first originated in the United States in 1975. Dr. Chuck Eastman, known as the "father of BIM," first proposed the idea of BIM and formally proposed the Building Description System (BDS). Subsequently, BIM technology began to develop rapidly. In 2003, the U.S. GSA[He, 2013]. In 2003, the U.S. GSA transformed the construction industry's technology by implementing a project called "National 3D-4D-BIM" and achieved good results. U.K. Government[Liu, 2014]. In 2011, the U.K. government also introduced policies to develop BIM by making its use mandatory[Deng, et. al., 2016]. In 2011, the U.K. government proposed in the "Government Construction Strategy" document that by 2016, the government needs to achieve full coordination of 3D-BIM and all documents are managed using I.T. Singapore Government[Xie, 2014] established a BIM fund to promote the application of BIM technology in public works, and plans to require 80% of construction companies to widely apply BIM technology by 2015.

Process Re-engineering Theory

With the rapid development of information technology since the middle and end of the 20th century, the business environment and operation methods have changed accordingly[Meng, 2019]. In 1993, Hammer and Champy published "Business Reengineering." Hammer and Ciampi started their practical exploration in the context of U.S. business operations and published "Business Reengineering" in 1993 to guide U.S. companies. They proposed the theory of Business Process Reengineering (BPR), that is, the goal of business development is to meet customer interests better and improve customer satisfaction.

In 2003, Thong[Zhao,2020] et al. summarized various BPR methodologies, tools, techniques, and critical success factors and proposed a genetic BPR algorithm to optimize business processes. In 2005, Damij et al. proposed the TAD (Tabular Application Development) method for business process modeling

and improvement, which significantly improved the efficiency of business process optimization. In 2016, Ghanadbashi argued that specific BPR application methods should be customized to suit the characteristics of the enterprise and BPR projects. The authors mention the BPR application process model by studying the salient BPR methods and abstract similarities and organizing them into a generic BPR methodological framework. In studying modeling and analysis methods, Lopes proposes introducing workflow diagrams into process descriptions in BPR. Phalp suggests how different notational approaches can be used to select helpful process models.

STATUS OF DOMESTIC RESEARCH

BIM Technology

The introduction of BIM technology in China was late. BIM technology and its related application technology were not introduced until after 2002. However, its development was speedily combined with the government's vigorous promotion. Many construction enterprises gradually became aware of BIM, which led to the emergence of several large BIM application demonstration projects. 2017 Ministry of Housing and Construction[Li, et. al., 2015] In the "Thirteenth Five-Year Plan" of the construction industry, it is proposed to strengthen the promotion of information technology, increase the application of BIM technology in engineering projects, and accelerate the application of integrated building information model (BIM) technology in the entire production process of engineering planning, investigation, design, construction, operation, and maintenance. He Guanpei[He,2010] et al. analyzed BIM technology by studying the multi-dimensional application of BIM technology in engineering construction and combining it with urban planning, cost management, and operation management, which pointed out the direction for the development of BIM technology in China in the future. Meanwhile, in 2011, He Guanpei[He,2010] re-explained the application of BIM technology in construction project management and proposed that the application of BIM technology in the construction industry needs the support of IFC, IDM and IFD.

Zhang Jianping[Zhang,2010] Through construction organization planning, quantity calculation, material planning, and other engineering management functions, the BIM construction management mode is thoroughly analyzed and studied, and a more comprehensive and complete construction management mode based on BIM technology is proposed. Baoming Yang[Yang,2013]Dr. Yang proposed that through the management and sharing of the project database platform established by BIM technology, construction enterprises of construction projects are provided with robust support. Thus BIM technology becomes a necessary tool for the project management of construction enterprises. 2010, Li

Heng[Fan, et. al., 2010] Given the defects of existing BIM technology, a BIM model more suitable for practical application is established by using the comparison method. The main difference between this and the traditional BIM model is that the construction unit takes the leading role.

Process Re-engineering Theory

Compared with foreign countries, it has not been long since China introduced the management concept of project process reengineering. The earliest was in 1994 when Professor Chen Yuli of Tsinghua University [Jia,2019] introduced the concept of business process reengineering for the first time at the National Industrial Engineering Annual Conference [Cui,2019]. In 1997, Professor Rui Mingjie and his students published the book "Reengineering Processes," in which they studied process reengineering in detail and proposed that the essence of process reengineering is to take customer needs as the starting point, think deeply about the workflow, and completely transform the process by redesigning business processes and combining process elements. Many other scholars have also conducted related research, among which Wang Fengbin is the first to study organizational change systematically [Chen,2018]. Her book "The Theory and Practice of Organizational Change in Enterprise Management" started a new wave of systematic research on organizational change in China. Then, in 2005, Liu Biao and other scholars [Liu, et. al., 2005]. In 2007, Hu Bin proposed an evaluation index system to reflect the comprehensive performance of business processes regarding process cost, process efficiency, and customer service satisfaction[Hu,2017]proposed to combine project management theory and process reengineering theory and apply the ideas, techniques, and tools of project management to process reengineering to achieve the purpose of enterprise resource optimization.

In summary, many scholars at home and abroad have made many contributions to the development and promotion of process reengineering theory, which has laid the foundation for the subsequent application of process reengineering theory to practical projects, intending to reduce unnecessary losses by changing the project operation process and thus improving enterprise efficiency. However, relatively few studies have been conducted on process reengineering theory, and some of them only provide theoretical directions and need more guidance for practical project applications.

CONCLUSION

The construction industry is a pillar of China's national economy and has significantly contributed to social and economic development and improved people's livelihood. However, in the context of continuous promotion and application of BIM technology, many construction enterprises introduce and apply BIM technology with low return on

investment or even loss, so how to use BIM technology to design new project management processes and promote the integration of BIM technology and engineering project management has become an urgent problem we need to solve. China's BIM technology still needs to be improved to promote. The application rate is low. Through the project management process, reengineering can effectively combine BIM technology and engineering project management and then promote the application of BIM and the improvement of the enterprise project management refinement level.

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