

The Development for BIM Contract Management System in China^{1, 2}

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ABSTRACT

Building information modelling (BIM) is the management of information through the whole life cycle of a built asset through three-dimensional visual expression, 4D time, 5D effect and multi-dimensional performance, in-kind control and precise control of the project to increase the contract manager's control of the project. At present, China(mainland) has not been specifically BIM contract management regulations. (Mainland of China has different management regulations with Hongkong, in this paper the author only analysis situation of mainland.) With the rapid development of China's market economy, the construction industry has become increasingly prominent in the national economy. In order to give full play to the role of market economy system reform in the allocation of market resources, China need to establish an effective legal system of contract management system.

Keywords: BIM, contract management system, construction project, contract standard regulations, technical operations, contract relationship

INTRODUCTION

Building information modelling (BIM) is the management of information through the whole life cycle of a built asset through three-dimensional visual expression, 4D time, 5D effect and multi-dimensional performance, in-kind control and precise control of the project to increase the contract manager's control of the project. Construction activities including the initial bidding and maintenance are the series performance combination of construction contracts, its consistency requires a high degree of legal awareness, contract of entire construction project plays an important role in the project management. All rights relationships between the management of each party based on contract, especially the contract management of large-scale construction projects which directly determine the progress of the project.

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1. Problem definition

In order to solve problems of BIM contract management, the American Institute of Architects (AIA) and Consensus Docs. put forward their own BIM contract standard form respectively AIA Document E202TM-2008 Building Information Modeling Protocol Exhibit and Consensus DOCS301 BIM. The construction contract in China is based on the standard form by the Ministry of Housing and Urban-Rural Development and the State Administration for Industry and Commerce. At present, China(mainland) has not been specifically BIM contract management regulations. (Mainland of China has different management regulations with Hongkong, in this paper the author only analysis situation of mainland.)

With the rapid development of China's market economy, the construction industry has become increasingly prominent in the national economy. In order to give full play to the role of market economy system reform in the allocation of market resources, China need to establish an effective legal system.

To summarize, this paper will research and analyze the following questions:

- 1) The advantages of BIM contract management system compared to the traditional contract management system
- 2) Comparing between published BIM contract standard firm with Chinese situation.
- 3) Try to choose a sample system model that is suitable for China's contract management.

METHODOLOGY

In the analysis of this paper, the author uses Dominance method as the main methodology. Dominance method as one of the Multi-Attribute Decision Making (MADM) methods, is more useful and practical especially when there are subjective attributes. As mentioned before, we planned to compare between BIM contract management system with traditional contract management system, and published BIM contract standard firm with Chinese situation. By using Dominance method, we could easily find out a good direction to build a sample contract management system model that is suitable for China, and clearly know the advantage of BIM contract management system construction.

2. Development of the Alternatives

After understanding what a BIM contract management system is, the paper will look at the differences between BIM contract management system and traditional contract management, what are strength and weakness of these. From this, it will be possible to define 2 alternatives about the contract management systems in China:

To summarize, this paper will research and analyze the following questions:

- 1) Using BIM contract management system with Chinese situation

2) Using traditional contract management system with Chinese situation

3. Development of the outcomes and cashflows for each alternative

With the rapid development of China's market economy, the construction industry has become increasingly prominent in the national economy. In order to give full play to the role of market economy system reform in the allocation of market resources, China need to establish an effective legal system of contract management system.

The first alternative is using BIM contract management system in China. Building information modelling (BIM) technology uses three-dimensional visual expression, 4D time, 5D effect and multi-dimensional performance, in-kind control and precise control of the project to increase the contract manager's control of the project. But until now, China's contract system management of building construction with BIM technology is still blank.

The second alternative is using traditional contract management system in China. The construction contract in China is based on the standard form by the Ministry of Housing and Urban-Rural Development and the State Administration for Industry and Commerce. At present, China (mainland) has not been specifically BIM contract management regulations. It is difficult to change this situation in a short time.

4. Selection of a criteria

Here, we basically select the following criteria for comparing those alternatives:

Selection attributes	Management ability	Co-ordinated management	Progress management	Policy supporting	Information sharing	Risk management	Change management	Professional personnel supporting
Management ability	0	0	0	0	0	0	0	0
Co-ordinated management	1	0	0	0	0	0	0	0
Progress management	1	1	0	0	0	0	0	0
Policy supporting	1	1	1	0	0	0	0	0
Information sharing	1	1	1	1	0	0	0	0
Risk management	1	1	1	1	1	0	0	0
Change management	1	1	1	1	1	1	0	0
Professional personnel supporting	1	1	1	1	1	1	1	0
Total	7	6	5	4	3	2	1	0
Rank	8	7	6	5	4	3	2	1

As each criterion is not weighed the same level. An Ordinal scale that will respectively amount from 0 to 1 to each criterion is used. It is the most appropriate Ratio Scale because this paper will analyze the rank of the criteria.

FINDINGS

5. Analysis and comparison of the alternatives

1. Comparing between BIM contract management system with traditional contract management system in China.

Thanks to these attributes, we can compare different criteria through a multi attribute decision making (MADM) analysis by using Compensatory model of Additive Weighting Technique.

The comparison is as follow: Here we quantify each criterion with the score from 1 to 4

Management ability		Co-ordinated management		Progress management		Policy supporting	
Very strong	4	Very strong	4	Very strong	4	Very strong	4
Strong	3	Strong	3	Strong	3	Strong	3
Weak	2	Weak	2	Weak	2	Weak	2
Very weak	1	Very weak	1	Very weak	1	Very weak	1
Information sharing		Risk management		Change management		Professional personnel supporting	
Very strong	4	Very strong	4	Very strong	4	Very strong	4
Strong	3	Strong	3	Strong	3	Strong	3
Weak	2	Weak	2	Weak	2	Weak	2
Very weak	1	Very weak	1	Very weak	1	Very weak	1

Selection attributes	BIM contract management system	Traditional contract management system
Management ability	4	2
Co-ordinated management	1	4
Progress management	4	2
Policy supporting	1	4
Information sharing	4	1
Risk management	3	1
Change management	4	1
Professional personnel supporting	1	4
Total	22	19

So up to now, we calculate the score of each alternative. Then we need to use the additive weighing for each alternative:

Additive Weighting Technique				
Selection attributes	Relative rank	Normalized weight	BIM contract management system	Traditional contract management system
Management ability	8	$8/36=0.222$	0.888	0.444
Co-ordinated management	7	$7/36=0.194$	0.194	0.776
Progress management	6	$6/36=0.167$	0.668	0.334
Policy supporting	5	$5/36=0.139$	0.139	0.556
Information sharing	4	$4/36=0.111$	0.444	0.111
Risk management	3	$3/36=0.083$	0.249	0.083
Change management	2	$2/36=0.056$	0.224	0.056
Professional personnel supporting	1	$1/36=0.028$	0.028	0.112
Total	36	1	2.834	2.472

6. Selection of the preferred alternative

In order to give full play to the role of market economy system reform in the allocation of market resources, China need to establish an effective legal system for contract management.

2. The necessity of Using BIM Technology for Construction Project Contract Management. (The advantages of BIM contract management system.)

The National Institute of Standards and Technology (NIST) released that the construction industry lost 15.8 billion dollars in data exchange problems during recent 200 years, and the UK Office of Government Commerce (UKOGC) also predict the 30% cost of construction projects can be saved through informatization management. Without a doubt BIM is one important tools of informatization technology which can solve such problems. Contract management is a way to constrain and regulate the behavior between all parties, and it is also a way to effectively improve the management level. BIM technology can enhance its rigor and effectively solve the following problems:

1) Achieve dynamic management of construction contract

In the construction contract, the contract price and contract duration are the biggest factor of project change. The contract change is difficult to avoid, in another hand it is the best way to get optimal planning in the construction project. BIM technology uses three-dimensional visual expression, 4D time, 5D effect and multi-dimensional performance, in-kind control and precise control of the project to increase the contract

manager's control of the project. BIM contract management can reduce unnecessary changes, achieve dynamic management of construction contract.

2) BIM contract management can enhance management ability.

In the process of contract management, more and more contract disputes are happened in the later maintenance stage. Build an asset management platform based on BIM data is the good choice to integrate property management and asset management, it can reduce operation costs and solve complex data problems.

3) BIM contract management can reduce risk.

BIM technology used in construction contract management can track and predict the entire project life cycle. The traditional contract risk allocation adopts the principle of predictable risk distribution. It is difficult to achieve the goal of cost reduction and risk reduction without fully considering both the preference and ability problems of risk events and the rational and effective risk allocation. The continuous improvement of BIM technology has gradually improved the control of information and the distribution of resources, obtained effective resources in real time, improved the treatment of risks and improved the equality of interests of all parties by improving various resources.

4) Facilitate the sharing of engineering information

In the traditional contract management of construction projects, a large number of designing departmental units often lags behind the input and output of construction contract information, hindering the smooth progress of the entire project, resulting in "information silos". BIM technology is the core of data sharing and conversion, through the establishment of a BIM building information platform, the platform integrates Glodon, Tekla, Magi CAD, Revit and other BIM software tools to build the model, such as Word, Excel and other office software data, and each participant's own software interface to the data. So, contract management department can extract the contract directly from the database information, and the data will change as the original data changes, the data can be updated in time to achieve the project implement smoothly.

5) Optimize project contract clause

At present, there is not BIM standard for project management in China. Clarifying the rights and obligations of each project participants in the BIM contract firm could ensure each project progress process smoothly, and improve the efficiency of project management. BIM technology can make project contract management simulation that based on the actual situation, to make sure responsibility clearly of each part in the whole construction project.

7. Performance Monitoring and post-evaluation of results

3. Comparing between published BIM contract standard form with Chinese situation. (The obstacles of BIM contract management in China)

In the construction project, perfecting the contract is an important way to avoid the risk during construction process and could be a tool to ensure the construction implementation smoothly. Until now, China's contract system management of building construction with BIM technology is still blank.

The American Institute of Architects(AIA) and Consensus Docs. put forward their own BIM contract standard form to solve problems of BIM contract management, respectively AIA Document E202TM-2008 Building Information Modeling Protocol Exhibit and Consensus DOCS301 BIM. The construction contract in China is based on the standard form by the Ministry of Housing and Urban-Rural Development and the State Administration for Industry and Commerce. At present, China(mainland) has not been specifically BIM contract management regulations. Implement BIM contract management in China has following obstacles:

1) Lack of uniform BIM standard firm

Due to the BIM contract management start late in China and lack of relevant project contract management documents, leads the contract standard languages for BIM applications are lacking in all stages of the project, this is also the main problem of the comprehensive developed of BIM technology in the China construction industry. Compared with developed countries, the BIM technology of construction management does not have a complete workflow in different stages for each participant. Especially in terms of contract management, based on the traditional contract texts, the standardized management of BIM technology can not be achieved. To solve the obstacles of BIM application in China, it is necessary to formulate a corresponding BIM standardized contract management system according to the actual situation.

2) Lack of BIM co-ordinated management

BIM development encounter dilemma in collaborative, because there is not BIM co-ordinated management in China. Construction projects need to be coordinated and managed by multiple parties with complicated communication management. BIM lack of collaborative design in the application of domestic projects, and the information of different disciplines and participants at different stages of the project lacks overall management. BIM related software involves different professions. Hence BIM provides a new platform for collaborative designing.

3) Lack of professional and technical personnel

The establishment and management of a construction contract is an all-process project with dynamic, systematic and complex. It requires many highly qualified and professional personnel to manage the construction contract. Currently in China, BIM construction projects, construction contract management staff are not professional BIM technical staff, without the professional technical knowledge, legal knowledge and cost management knowledge, this situation is not conducive to the progress of the project.

CONCLUSIONS

At present, China (mainland) has not been specifically BIM contract management regulations. It is difficult to change this situation in a short time. In the construction project, perfecting the contract is an important way to avoid the risk during construction process and could be a tool to ensure the construction implementation smoothly. Until now, China's contract system management of building construction with BIM technology is still blank.

Contract management is a way to constrain and regulate the behavior between all parties, and it is also a way to effectively improve the management level. BIM technology can enhance its rigor and effectively solve the many problems of contract management system.

Due to the BIM contract management start late in China and lack of relevant project contract management documents, leads the contract standard languages for BIM applications are lacking in all stages of the project, this is also the main problem of the comprehensive developed of BIM technology in the China construction industry. These reasons are why using BIM Technology for Construction Project Contract Management system in China is necessary.

FOLLOW ON RESEARCH

At present, the using and research of BIM technology in engineering construction is still in infancy, and many practical strengths have not been developed. With the development of science and technology, BIM technology will be closely integrated with more contractual documents and more demonstrative texts will be produced, which will contribute to the development of BIM construction contracts Management, improve the efficiency of BIM technology, so as to promote the process of information management in our country.

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