World Journal of Social Science Research
ISSN 2375-9747 (Print) ISSN 2332-5534 (Online)
Vol. 5, No. 1, 2018
www.scholink.org/ojs/index.php/wjssr

*Original Paper*

# Research on the Influencing Factors of the Adoption of BIM Technology

Dong Zhai[1] & YaJun Pang[1*]

[1] Zhejiang University, Hangzhou, China

[*] YaJun Pang, Zhejiang University, 310058, Hangzhou, China

Received: January 28, 2018 Accepted: February 12, 2018 Online Published: February 28, 2018
doi:10.22158/wjssr.v5n1p82 URL: http://dx.doi.org/10.22158/wjssr.v5n1p82

***Abstract***

*The use of BIM technology adoption model of 192 sample data collected for analysis, draw the following conclusions: (1) the use of BIM technology influence significant behavior intention; (2) BIM significantly influence the perceived use intention; (3) the obstacle factors affect enterprises to reverse the intention of using the assumption of BIM technology is not established; (4) the progress, quality, cost, safety, environment, management and coordination factors have significant positive effect on the perception of users useful BIM technology; (5) technical factors are the major factors affecting the user; (6) human, economic, management and legal factors significantly influence the factors of perceived barriers to BIM technology.*

***Keywords***

*BIM, adoption, influencing factors*

## 1. Introduction

BIM technology has been recognized gradually in the global construction industry, Zhang Wei (2015) combined with the engineering examples to analyze the relationship between BIM and the quality of construction, and then the BIM technology is conducive to the realization of the related conclusion meticulous management of the project, Li Yadong (2013) combined with the application of super high-rise project in Shanghai, introduction the thought of quality management implementation based on BIM. Li Yong (2014) discusses the integration management method of construction schedule forecasting reliability management platform based on BIM, indicates that the relevant engineering examples, the proposed method has obvious effect on the control of construction schedule; Zhu Jiajia (2014) studies show that the application of BIM technology in the project schedule management system break through the limitation of traditional project schedule management, application of BIM the technology realizes the sharing of construction project life cycle information can be generated, the application of BIM technology benefits exist in the aspects of management, the application of BIM technology to achieve a multi establishment of multi information, team management of grass-roots labor groups to coordinate discussions, to maximize the production efficiency is improved. The research of Wu Ku (2009) has established the BIM cost management system for the construction of transmission and transformation projects, which aims to control the cost of construction and improve the efficiency of construction. Wang Guangbin and so on (2009) proposed and compared 3 methods of cost calculation with BIM technology, and analyzed each technical scheme at the same time. Zhong Qing (2014), based on the study of the integrated application of BIM and RFID in the field of construction both at home and abroad, built a safety and civilization monitoring system for the construction site, so as to achieve the purpose of automation, visualization and multi-party coordination of relevant information on the construction site. However, even if the BIM for the construction industry in improved efficiency and obtain the economic benefits of the whole construction industry has been extensive understanding and awareness, according to Building SMART statistics, 46% Chinese design enterprises in the application of BIM technology in 15% projects to the construction of BIM technology application in enterprise rate is less than 31%, BIM technology the adoption is far lower than expected behavior. The development and diffusion of BIM technology has unique rules, and the technology adoption category includes BIM technology adoption problem. Therefore, this paper will draw on the related theories of information technology adoption to study the related problems of BIM technology adoption. Through the literature search and reading can be found, the application range of TAM model is the most widely used, so this paper will research based on BIM technology, combined with the theory of TAM model, put forward the integrated framework of TAM under construction BIM technology adoption model based on user BIM technology adoption for research, because the current technology adoption for BIM discusses the literature still to be added, to study the relationship between the factors of BIM promotion disorder is less, so this study has a certain innovation in the field.

## 2. Method

### *2.1 Model Framework Construction*

The object of this paper is the factors that influence the adoption of BIM technology. The purpose is to study the user's actual usage behavior of BIM technology from the perspective of the usefulness of BIM technology at the project level. The framework model of this paper divides the external variables of an organization (user) to the influence factors of BIM technology into obstacles and favorable factors. The specific model framework is shown in Figure 1 below:

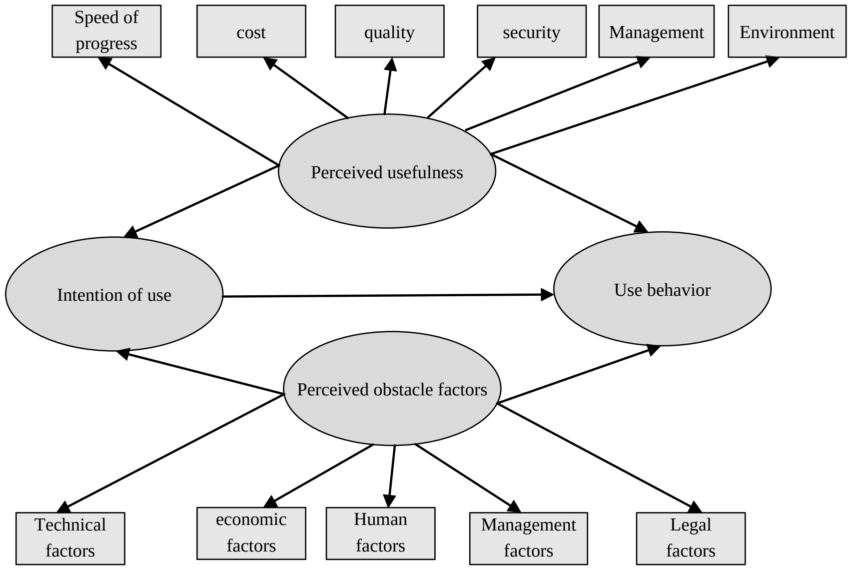


**Figure 1. User's Adoption Model for BIM Technology**

*2.2 Model Framework Construction*

According to the user adoption framework of BIM technology, this study proposes the factors that affect users' adoption of BIM technology. Combined with structural equation modeling, it establishes the adoption model of BIM technology by organization, and puts forward 16 hypotheses, as shown in Table 1 below.

**Table 1. Model Related Assumptions in this Pape**

| Serial Number | Hypothesis |
|---|---|
| H1 | Use intention is positively affecting the user's BIM technology usage behavior |
| H2 | Perceived usefulness is positively affecting the user's BIM technology intention |
| H3 | Perceived usefulness is positively affecting user BIM technology usage behavior |
| H4 | Obstacle factors reverse the usage intention of user BIM Technology |
| H5 | Obstacle factors reverse the use of BIM Technology |
| H6 | Progress factors are positively affecting the perceived usefulness of BIM user |
| H7 | Quality factors are positively affecting the perceived usefulness of BIM user |
| H8 | Cost factors are positively affecting the perceived usefulness of BIM user |
| H9 | Security factors are positively affecting the perceived usefulness of BIM user |
| H10 | Management factors are positively affecting the perceived usefulness of BIM user |
| H11 | Environmental factors are positively affecting the perceived usefulness of BIM user |
| H12 | Technical factors are positively affecting the perceived barriers of BIM user |
| H13 | Economic factors are positively affecting the perceived barriers of BIM user |

| | |
|---|---|
| H14 | Management factors are positively affecting the perceived barriers of BIM user |
| H15 | The positive impact of human factors on the perceived barriers of BIM user |
| H16 | Legal factors are positively affecting the perceived barriers of BIM user Technology |

### *2.3 Data Acquisition and Analysis Method*

In the form of interviews and mail, 192 valid questionnaires were collected and recovered. SPSS18.0 and AMOS20.0 software are used to process the collected data. SPSS software is used for the descriptive statistical analysis, reliability and validity test of collected data. AMOS software carries out confirmatory factor analysis and Structural Equation Modeling (SEM) hypothesis test for data models.

### *2.4 Data Quality Analysis*

#### 2.4.1 Reliability Analysis

The best reliability coefficient of the questionnaire is better than 0.8, and 0.7 to 0.8 can be accepted (the reliability coefficient of the subscale is more than 0.60). In this study, the reliability coefficient method was used to calculate the reliability coefficient of the questionnaire. No matter the reliability coefficient of the total scale or the reliability coefficient of the subscale, it can better meet the investigation requirements.

#### 2.4.2 Validity Test

The validity of structure is determined through three ways, namely, model coefficient evaluation, correlation coefficient evaluation, and evaluation of building model fitting (validation test is transformed into structural equation model fitting index evaluation). The lower Table 2 shows that the theoretical model is well fitted to the data (most of the indexes are fit), and the validity of the questionnaire is better.

**Table 2. Evaluation of Model Fitting Index**

| Index | $\chi^2$/df | RMR | GFI | IFI | NFI | PGFI |
|---|---|---|---|---|---|---|
| Integral Model | 1.12 | 0.02 | 0.962 | 0.964 | 0.75 | 0.698 |
| Perceived Usefulness | 1.922 | 0.157 | 0.924 | 0.955 | 0.911 | 0.596 |
| Perceived Obstacle Factors | 2.87 | 0.493 | 0.914 | 0.96 | 0.935 | 0.572 |
| Use Behavior-Intention of Use | 1.1 | 0.042 | 0.955 | 0.993 | 0.93 | 0.364 |
| Reference Value | 1-3 | <0.05 | >0.9 | >0.9 | >0.9 | >0.5 |

## 3. Result

The BIM technology adoption model hypothesis is tested by the significant results and parameter estimates from the AMOS output. The value of the standard regression coefficient between the latent variables is between 0 and 1, and the value is the strength of the variable causality. If the coefficient is close to 1, it indicates a strong causal relationship between variables, and conversely, when the coefficient is close to zero, the causality between the variables is weak. The results of the significant results and the parameter estimation of the BIM technology adoption model are summed up as shown in Table 3 as shown in the AMOS software.

**Table 3. Parameter Estimation and Saliency Results**

| Variable Influence Relationship | Normalize Dregression | P |
|---|---|---|
| Intention of use <--- Perceived usefulness | 0.542 | 0.002 |
| Intention of use <--- Perceived obstacle factors | -0.095 | 0.496 |
| Use behavior <--- Perceived usefulness | 0.118 | 0.487 |
| Use behavior <--- Perceived obstacle factors | 0.462 | 0.002 |
| Use behavior <--- Intention of use | 0.44 | 0.014 |
| cost <--- Perceived usefulness | 0.755 | *** |
| Speed of progress <--- Perceived usefulness | 0.685 | *** |
| quality <--- Perceived usefulness | 0.72 | *** |
| security <--- Perceived usefulness | 0.741 | *** |
| Management coordination <--- Perceived usefulness | 0.832 | *** |
| Environmental Science <--- Perceived usefulness | 0.753 | *** |
| Often used <--- Use behavior | 0.829 | *** |
| Always use <--- Use behavior | 0.624 | *** |
| Will continue to use <--- Use behavior | 0.527 | *** |
| Intended to use <--- Intention of use | 0.894 | *** |
| Will be used<--- Intention of use | 0.751 | *** |
| Possible use<--- Intention of use | 0.696 | *** |
| Technical factors <--- Perceived obstacle factors | 0.814 | *** |
| Human factors <--- Perceived obstacle factors | 0.49 | 0.001 |
| economic factors <--- Perceived obstacle factors | 0.620 | *** |
| Management factors <--- Perceived obstacle factors | 0.517 | 0.002 |
| Legal factors <--- Perceived obstacle factors | 0.479 | 0.004 |

Note. *** express $P<0.001$.

It is assumed that the intention of using H1: BIM technology is positively affecting the behavior of user BIM technology. According to Table 3, the path coefficient of the use behavior impact on the use behavior is 0.44, reaching a significant level of 0.05, the original hypothesis is established. For the hypothesis H2: perceived usefulness is positively affecting the user BIM technology use intention. According to Table 3, the path coefficient of perceived usefulness to adoption intention is 0.542, reaching a significant level of 0.01. The original hypothesis is established. For the hypothesis H3:

perceived usefulness is positively affecting the user BIM technology usage behavior. According to Table 3, the path coefficient between perceived usefulness and usage behavior is P=0.118>0.05, which does not reach a significant level, assuming that H3 is not established. For the hypothesis H4: obstacle factors reverse the user BIM technology usage intention. According to Table 3, the path coefficient of influence is -0.095, not reaching the significant level of 0.01, assuming H4 is not valid. For hypothesis H5: obstacle factors reverse the user BIM technology usage behavior. According to Table 3, the path coefficient of adoption intention to BIM technology usage behavior is 0.462, reaching 0.01 significant level, the original hypothesis is established. For hypothesis H6: progress factor positively affects user BIM technology perception usefulness. According to Table 3, the path coefficient of progress factor and perceived usefulness is 0.685, reaching 0.01 significant level. The hypothesis is established. For hypothesis H7: quality factors positively affect user BIM technology's perceived usefulness. According to Table 3, the path coefficient of quality factor and perceived usefulness is 0.72, reaching a significant level of 0.01, and the original hypothesis is established. For hypothesis H8: cost factors positively affect user BIM technology perceived usefulness. According to Table 3, the path coefficient of cost factor and perceived usefulness is 0.755, reaching a significant level of 0.01, and the original hypothesis is established. For hypothesis H9: safety factors positively affect user BIM technology perceived usefulness. According to Table 3, the path coefficient of safety factor and perceived usefulness is 0.741, reaching 0.01 significant level. The hypothesis is established.

For hypothesis H10: management coordination factors positively affect user BIM technology perceived usefulness. According to Table 3, the path coefficient of management coordination factor and perceived usefulness is 0.832, reaching a significant level of 0.01, and the original hypothesis is established. For hypothesis H11: environmental factors positively affect user BIM technology perceived usefulness. According to Table 3, the path coefficient of environmental factors and perceived usefulness is 0.841, reaching a significant level of 0.01, and the original hypothesis is established. For supposition H12: technology factors positively affect users' BIM technology barriers. According to Table 3, the path coefficient of technical factors and perceived barriers is 0.753, reaching a significant level of 0.01, and the original hypothesis is established. For hypothesis H13: the economic factors positively affect the users' BIM technology barriers. According to Table 3, the path coefficient of the economic and perceived barriers is 0.62, reaching a significant level of 0.01. The hypothesis is established. For hypothesis H14: management factors positively affect user BIM technology barriers. According to Table 3, the path coefficient of management factors and perceived barriers is 0.517, reaching a significant level of 0.01, and the original hypothesis is established. It is assumed that H15: human factors positively affect users' BIM technology barriers. According to Table 3, the path coefficient of human factors and perceived barriers is 0.49, reaching a significant level of 0.01. For hypothetical H16: the legal factors positively affect the user BIM technology perceived usefulness. According to Table 3, the path coefficient of environmental factors and perceived barriers is 0.479, reaching a significant level of 0.01, and the original hypothesis is established.

## 4. Discussion

This paper conducted a series of studies adopted for users of the BIM technology, the BIM technology adoption related variables (perceived barriers, perceived usefulness) analysis and behavior, the intention of using the relationship, according to the results of the study put forward the following suggestions to improve the user BIM technology adoption behavior:

(1) To reduce the user BIM technology is easy to use expectations, facing the obstacles to the application of BIM technology.

(2) To improve the useful cognition of BIM technology. From the BIM technology adoption model built in this paper, we can see that the cognition of BIM technology usefulness has great influence on users' BIM technology adoption intention, and BIM technology promotion and promotion need more input.

(3) In terms of promoting conditions, both the government and the enterprise level should be invested.

## References

Li, Y. D., Lang, H., & Wu, T. H. (2013). Engineering Quality Management Based on BIM. *Construction Technology*, *42*(15), 20-22.

Li, Y. (2014). Construction Progress BIM Reliability Prediction Method. *Civil Construction and Environmental Engineering*, *36*(4), 51-56.

Wang, G. B., Zhang, Y., & Tan, D. (2009). BIM Based Engineering Cost Accounting Theory and Implementation Method. *China Engineering Management Forum*, *26*, 47-49.

Wu, R. J., Zhao, C. X., Zhang, S. P., & Yu, G. (2016). Research on the Cycle Cost Management System of Transmission and Transformation Project Construction Based on BIM. *Engineering Cost Management*, *4*, 29-32.

Zhong, Q., Su, Z. M., & She, X. J. (2014). *BIM RFID and the Construction of Integrated Construction Site Safety Monitoring System Based on Building Economy*, *35*(10), 35-39.

Yao, X. T., & Row. (2008). Analysis of Management Research and Social Network. *The Modern Management Science*, *6*, 19-21.

Zhu, J. J., & Tan, F. (2014). Application of Bim Technology in Project Schedule Management System. *Project Management Technology*, *12* (5), 38-42.