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Building information modelling (BIM) framework for practical implementation

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A B S T R A C T

Recent advances in building information modelling (BIM) have disseminated the utilization of multi-dimensional (nD) CAD information in the construction industry. Nevertheless, the overall and practical effectiveness of BIM utilization is difficult to justify at this stage. The purpose of this paper is to propose a BIM framework focusing on the issues of practicability for real-world projects. Even though previous efforts in the BIM framework have properly addressed the BIM variables, comprehensive issues in terms of BIM effectiveness need to be further developed. A thorough literature review of computer-integrated construction (CIC) and BIM was performed first in order to interpret the BIM from a global perspective. A comprehensive BIM framework consisting of three dimensions and six categories was then developed to address the variables for theory and implementation. This framework can provide a basis for evaluating promising areas and identifying driving factors for practical BIM effectiveness.

1. Introduction

Utilizing information systems (IS) in the construction industry has been an issue of great importance in order to enhance the effectiveness of construction projects throughout their life cycle and across different construction business functions. However, the concept of IS in construction is very broad and subjective [17]. Formulating comprehensive frameworks of IS in construction, therefore, would effectively facilitate the strategic utilization of IS.

By definition, a framework is a systematic set of relationship or a conceptual scheme, structure, or system [46]. The purpose of establishing a framework is to guide research efforts, to enhance communications with shared understanding, and to integrated relevant concepts into a descriptive or predictive model [23,33]. Another notion is that a lack of perspective in observing IS not only wastes costly computing resources, but mismanages more expensive ones, human resources.

Computer integrated construction (CIC) and building information modelling (BIM) are the most often used acronyms representing this broad concept of IS in construction. Nevertheless, there have been limited efforts in systematically defining these concepts as a framework for theory and implementation. The purpose of this paper is to provide a comprehensive framework of BIM in order to evaluate promising areas and to identify driving factors for practical applications in real world construction projects.

2. CIC and BIM: reciprocal convergence

In an attempt to develop an IS planning methodology prioritizing construction business value chains, Jung and Gibson [17] defined CIC as “the integration of corporate strategy, management, computer systems, and information technology throughout the project's entire life cycle and across different business functions”. In this definition, managerial issues including ‘corporate strategy’ and ‘management’ were strongly stressed by utilizing several analytical methodologies developed for assessing the effectiveness of integrated implementation of CIC concepts.

They [17] pointed out the needs for managerial effectiveness of gigantic integration of construction information systems, as technical solutions had been well developed even in the mid-1990s. On the other hand, recent proliferation of BIM has expanded its concept into comprehensive utilization in order to maximize the benefits. These two different approaches indicate a convergence in terms of optimizing the use of IS in the construction industry.

Besides the effectiveness, another frequently investigated sub-issue for CIC and BIM was the integration between graphical data and non-graphical data among many different construction business functions [17,37,42]. The perspectives where construction IS was utilized, namely, the project, organization, or industry level perspectives, were also an issue of research interests.

2.1. Top-down: curtailment in CIC scopes

CIC efforts in the 1990's had generally tried to incorporate entire graphic data and non-graphic data throughout an organization or a project. Three examples of CIC implementations are introduced here in order to interpret the practical implications.

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