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A theoretical framework of a BIM-based multi-disciplinary collaboration platform

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ABSTRACT

Most complex projects in the Architecture, Engineering, and Construction (AEC) industries involve multi-disciplinary collaboration and the exchange of large building data set. Traditionally, the collaboration efforts across the disciplines have been based on the frequent exchange of 2D drawings and documents. However, during the past decade, the widespread adoption of object-oriented Computer-aided Design (CAD) tools has generated more interests in Building Information Modelling (BIM). A number of BIM-compliant applications such as analysis tools, model checkers and facility management applications are being developed. This paper develops a theoretical framework of technical requirements for using BIM-server as a multi-disciplinary collaboration platform. The methodologies that are used to develop the framework include focus group interviews (FGIs) with representatives from the diverse AEC disciplines, a case study of an Architectural project using a state-of-the-art BIM-server, and a critical review and analysis of current collaboration platforms that are available to the AEC industries. This paper concludes that greater emphasis should be placed on supporting technical requirements to facilitate technology management and implementation across disciplines. Their implications for user-centric technology development in design and construction industry are also discussed.

1. Introduction

Traditionally, the inter-disciplinary collaboration in the Architecture, Engineering, and Construction (AEC) industries has revolved around the exchange of 2D drawings and documents. Even though the separate design disciplines have been using 3D models and applications for visualization and design development, the collaboration practices have remained more or less 2D-based until recently. The widespread use and proliferation of object-oriented Computer-Aided Design (CAD) packages and increased constructability and level of automation in construction processes provide encouraging motives for the exchange of 3D data in the collaboration process. Building Information Modelling (BIM) is envisaged to play a significant role in this transformation. BIM is an advanced approach to object-oriented CAD, which extends the capability of traditional CAD approach by defining and applying intelligent relationships between the elements in the building model. BIM models include both geometric and non-geometric data such as object attributes and specifications. The built-in intelligence allows automated extraction of 2D drawings, documentation and other building information directly from the BIM model. This built-in intelligence also provides constraints that can reduce modelling errors and prevent technical flaws in the design, based on the rules encoded in the software [11,16,21]. Most recent CAD packages such as ArchiCAD and Revit have adopted the object-oriented approach with certain BIM capabilities. A number of supporting applications have emerged that can exploit the information embedded in the BIM model for model integration, design analysis, error checks, facility management (FM), and so on [20]. The emergence of multiple applications with the ability to directly use and exchange building information between them provides opportunities for enhanced collaboration and distributed project development. BIM is increasingly considered as an Information Technology (IT)-enabled approach that allows design integrity, virtual prototyping, simulations, distributed access, retrieval and maintenance of the building data [12]. Hence, the scope of BIM is expanding from the current intra-disciplinary collaboration through specific BIM applications to multi-disciplinary collaboration through a BIM-server such as EDMmodelServer™ that provides a platform for direct integration, storage and exchange of data from multiple disciplines. A BIM-server is a collaboration platform that maintains a repository of the building data, and allows native applications to import and export files from the database for viewing, checking, updating and modifying the data. In general, a BIM-server by itself has limited built-in applications. BIM-servers are expected to allow exchange of information between the various applications involved in a building project life cycle including design tools, analysis tools, FM tools, document management systems (DMS), and so on. In principle, BIM-servers aim to provide collaboration capabilities which are similar to DMS. However, while DMS are meant for collaboration through exchange of 2D drawings and documents,

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