Enhancing Construction Processes Using Building Information Modelling on Mobile Devices

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ABSTRACT

This paper reviews existing construction processes of a Leading International Engineering Contracting firm in the Middle East and investigates the potential of improving existing processes using mobile Building Information Technology and processes. Qualitative data was captured through detailed interviews with key personnel, site observations and existing site processes that are mapped from site mobilisation to practical completion stage. Industry practitioners whom were involved in the project have validated the to-be process maps. The paper identifies non-adding value activities in the existing processes and highlights the potential of using mobile technologies in addressing limitations of the as-is processes. The paper also highlights the potential of enhancing efficiency and effectiveness of existing processes using readily available technologies.

Keywords: Building Information Modelling (BIM), Communication Technologies, Construction Industry, Mobile BIM, Process Improvements

INTRODUCTION

The Middle East Construction Industry is undergoing rapid change due to wide internal and external drivers that result from changes in the economic, socio-technical and political landscape. Construction Contractors usually survive on razor thin profit margins, and are always looking for new ways to enhance productivity and efficiency in existing business processes. The current processes demonstrate and encourage all industry involved parties to create a transformation, considering its underachievement and much of the inefficiencies that it faces, both in terms of meeting its requirements and those of its private and public sector client (Egan, 1998). In recent years, there has been a gradual shift in developed countries towards a more integrated approach to construction project design and delivery, with a view to address inefficiencies inherent within construction processes.
In the Middle Eastern context however, adoption of such approaches remain limited. There is some reluctance in the uptake of Building Information Modelling (BIM) based technology processes, and integrated approaches to working, such as Integrated Project Delivery (IPD). BIM inherently facilitates IPD (2009) by ensuring key stakeholders and Contractors’ early involvement that results in better communication and co-ordination between involved parties. The potential to enhance construction productivity by addressing key communication and co-ordination processes is inherent in traditional document centric methods of project delivery. Using BIM as a tool for Design and Management can drastically improve construction efficiencies, seeing that BIM provides structured information that ensure delivery of information to concerned stakeholders at different stages of a project life cycle.

A vast majority of existing BIM implementations are geared towards the need of office-based workers using fixed computers. Information need of mobile workers operating in the field, are not adequately addressed by existing solutions. This paper investigates the potential of exploiting Mobile based BIM technologies that enhance the existing processes and workflows using both exploratory and descriptive research. The authors review the case study current existing processes, and reflect improvements that benefit from the emerging technologies of Mobile BIM. By creating a scenario based user-needs analysis, improvements on future processes are examined and stipulated

2. LITERATURE REVIEW

In the Construction Industry, the efficient and effective management of information is important to the success of a project. Methodologies such as knowledge management systems (El Gohary and El Diraby, 2010), innovation management systems (Girmscheid and Hartmann, 2001) and integrated collaborative systems (Dave and Koskela, 2010) are research efforts aimed at improving the control of information by project participants in a system. Aiming to exploit mobile devices to create a medium that will facilitate the dissemination of information during site activities.

In recent years, there has been phenomenal growth in the area of mobile computing and its applications to enhance construction processes. Some of these approaches have focused on developing a conceptual framework or platform to provide real time connectivity. Whilst other researchers have focused on developing various tools to address the issue of productivity, Chen and Kamara (2011) introduced a framework for the implementation of mobile computing in Construction Sites, which involves an application and a technical model. The application model identifies key opportunities, interactions and restrictions in the use of mobile BIM, while the technological model offers the user a framework to design mobile BIM systems from a technical perspective. Kim et al. (2011) developed a Software Development Kit, to present a location-based construction site management system using a mobile computing platform.

Nourbakhsh et al (2012) presented results of usability testing of a mobile application prototype for improving information management in construction projects (Kim et al., 2013), which developed an effective on-site management system. The system efficiently managed, transferred, and visualized project information on a mobile computing platform. Kuo et al. (2013) developed a mobile augmented reality positioning system for indoor construction application, by tracking user coordinates and their vision angles to realize three-dimensional indoor positioning with high environmental adaptability. Furthermore, Van Krevelen and Polemane (2010) researched the capabilities and limitations of mobile devices in relation to augmented reality, which can be performed for onsite construction activities.

On the other hand, Chen and Kamara (2008) study focus on mobile BIM adoption approaches by identifying key opportunities in adopting mobile devices for on-site information management practices and developing a model for retrieving and transferring information on-site. The study presented the following step-by-step
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