A Theoretical Comparison of Traditional and Integrated Project Delivery Design Processes on International BIM Competitions

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ABSTRACT

The Architectural Engineering and Construction (AEC) industry experiences higher rates of iteration, material wastage and poor cost management in comparison to other design industries. In an attempt to address such inefficiencies and control project budgets, various Governments are insisting that Building Information Modelling (BIM) is used by the appointed design teams on high value public buildings. Such legislation has been introduced in order to encourage a standardised level of collaborative working throughout the design process by enhancing interoperability of project information between design and construction professionals. In this paper, the MacLeamy Curve, a theoretical graphical representation of how integrated project delivery (IPD) processes improve efficiencies and allow for the reduction of costs by resolving issues during the earlier stages of the project, as well as other associated benefits are tested on both traditional and IPD design processes within two 48 hour international openBIM competition projects: Build London Live; and Build Qatar Live. The projects are compared by analysing the planned project programme against the reality, measured through recorded project exchanges, using a graphical representation. The findings of this paper suggest several recommendations, including: a collaborative design process appears to reduce iteration and results in a more comprehensive conceptual design at an early stage in comparison to a traditional process; more information and documentation is produced; and the overall programme is exceeded. Such findings suggest improved time, cost and design quality control.

Keywords: Building Information Modeling (BIM), Case Studies, Collaboration, Colocation, Integrated Project Delivery (IPD) Processes

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1. BACKGROUND

1.1. Current State of AEC Industry

The construction industry is a major contributor to the global economy. It delivered around £69 billion GVA (£107bn output) to the UK economy in 2010 employing around 2.5 million workers and as such is a key contributor to UK growth (HM Government, 2012). It has a similar impact on other nations economy and is one of the largest industries in the United States (U.S. Department of Commerce, Bureau of Economic Analysis, 2010) and European Union.

Despite its scale and importance to national economic performance, the industry has a well-documented record of inefficiency. Productivity in the construction industry has been declining since 1964 (Teicholz, 2004) with the productivity within the US field construction industry relative to all non-farm industries from 1964 through to 2004 (Eastman et al. 2008). During this 40-year period US productivity outside of construction has doubled. The industry is often characterized as inefficient, wasteful, combative and fragmented with each team responsible for its own silo of work and attempting to maximise their individual profit in the area of their own expertise (Pelburg, 2009; Lichtig, 2006). In the meantime, other industries have increased productivity and increased customer value (Kieran & Timberlake, 2004), resulting in a need of improvement within the AEC industry (Gallaher et al., 2004).

Horman and Kenley (2005) report that across a variety of circumstances and contexts, 49.6% of construction operative time is devoted to wasteful activities. Studies reveal that such activities can take up 26-40% of the overall project time (Ireland, 1995; Han et al. 2008), with other research efforts indicating that 40-60% of all construction phases are running longer than planned, which could increase the likelihood of projects exceeding their budget (Jergeas et al., 2000; Naoum 1994). Such actions have been defined as non-value adding activities (NVAAs) and are often a result of inadequate design information, (Koskela, 1992).

1.2. Government Mandates for Change

Construction is heavily influenced by the direct and indirect levers from the public sector, which produces around 30% of the UK industry’s output, therefore commitments to renew and expand national infrastructure are significant to the sector (BIS 2012). In an attempt to improve performance, various governments have identified the implementation of Building Information Modelling (BIM). A key aspect of BIM protocols is Integrated Project Delivery (IPD), a formal collaboration that occurs throughout the design, planning, and execution phases of a project (Lozor & Kelly, 2012). IPD as a delivery method attempts to address the problems of waste and adversarial relations in the AEC industry, and to increase efficiency and the likelihood of project success (Lichtig, 2006; American Institute of Architects and AIA California Council, 2007; Autodesk, 2008).

Since 2007, the American Institute of Architects has developed methodologies and contracts to support integrated philosophies (Cohen, 2010). In the UK in 2002, the Strategic Forum for Construction published ‘Accelerating Change’, which also called for integrated project teams, integrated supply chains and integrated work flows (Egan, 2002). The Construction Industry Council (CIC) has been at the forefront of developing and leading the UK Government’s mandate that public sector centrally procured construction projects will be delivered using BIM by 2016.

BIM adoption is often categorised using the Bew-Richards BIM Maturity Index (Figure 1). In order for the AEC industry in the UK to reach Level 2 by 2016, the CIC have laid the foundations for the production of a ‘digital plan of works’ which will help to inform an industry aligned process. The new workflow appears in the form of the PAS1192-2 specification which sets out standards for collaboration and interoperability between the various disciplines involved in Level 2 BIM projects (BIM Taskgroup, 2013). This process envisions a reconfiguration of the design process, shifting design decisions
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