

ABSTRACT

Researchers have attributed poor design-construction interface and inadequate stakeholder synergy as the root cause for time and cost overrun in construction projects. In the modern world, financial viability and value for money are weighed against all other criterion for the project's success. Constructability of design and accountability to the cost are the bench marks of value engineering in a collaborative multi-disciplinary industry like construction. Majority of the research study carried out in the design-construction interface is monitoring and control specific as it is traditionally believed that managing manpower and material on the site is the most challenging activity having a direct bearing on schedule and cost. The main cause of schedule deviation is change orders in majority of the projects, apart from force majeure situations. Gap exists in addressing constructability during design process and accountability in procurement management which triggers change order at a later stage of execution. The design sequence and ingredients which defines the cost and envisaged value of the project are still a grey area due to presence of uncertain parameters of constructability. Constructability and accountability need to be targeted during design phase to deliver the intended target values set by the initiation and planning team.

Two pilot studies on completed projects suggested a relook into the rationale of defining constructability and accountability through the lens of a designer. Lack of coordination among civil, mechanical and electrical disciplines were evident in clashes detected. The accountability of coordination and collaboration with visualisation were not well defined which caused hiccups during execution. The design-construction interface issues have proved to be affecting time and cost overrun in the case-lets examined. The need to understand design challenges over a wider spectrum of scenarios was felt to suggest better incorporation of constructability as a design philosophy in Building Information Modelling (BIM). BIM is still in an evolutionary phase and in the last two decades, construction industry has invested good sum of money for automating the design process viz. architectural models, structural analysis, detailing software, cost estimation and clash detection. But the commensurate saving in schedule and budget are not evident. The literature available on the subject recommends robust automation for monitoring and control techniques to pass on real time information from site to design office to address time and cost

overrun. The lack of collaborative visualisation and design-construction interface issues which caused the change orders are not adequately addressed to suggest a way forward.

Hence the main objective of the research is to examine the role of BIM in decision making during design through visualisation. Constructability, accountability and stakeholder synergy are analysed through twelve case studies to understand the design-construction interface issues in BIM projects. To address the objectives, a mix of qualitative and quantitative approach has been adopted to benefit from the advantages of both. Case-lets involving design and construction failures are analysed to study the role, composition and hierarchy of the design team to assess the degree of constructability in the decision-making process. A constructability impact index (CII) has been formulated by iterative design process where a numerical approach provides quantification parameters to constructability. Visualisation of schedule, cost, sustainability and facility management in BIM are explored to draw a more realistic picture on constructability and ascertain accountability at an early stage of the project. Iterative design process and forensic schedule analysis have been adopted to extract the essence from the case-lets. The results of the study suggest the need of better quantification and statistical significance in defining constructability and accountability. Target value design and design for excellence (DfX) challenges are analysed in case lets involving off-site construction to address specific design-construction interface problems. Varying degrees of design-construction interface issues have been critically examined to highlight the necessity of collaborative visualisation and clash detection during design phase.

The research brings out the importance of objective collaboration between various stakeholders to achieve better synergy during design and construction in an interdisciplinary field of construction project management. Policy changes for achieving better stakeholder synergy and accountability have been proposed after analysing the results. The constructability-cost trade off puzzle has been addressed with a fair degree of accuracy by the iterative design process where accountability can be fixed to a greater extent as envisaged in the research design. Role of BIM in off-site and manufactured construction to formulate a water tight design framework are also included in the research itinerary, being closely associated with constructability and accountability.

Key Words: Design-Construction Interface, Constructability, Accountability, Stakeholder Synergy, Procurement, Iterative Design, Visualisation, DfX, BIM.