UNIVERSITY OF CAMBRIDGE
Department of Engineering

CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

People Factors Influencing DfMA Design Integration; A Product or Service?

The offsite manufacturing market is a rapidly growing sector that has recently gained growing UK Government backing to improve construction productivity and facilitate the wider digital agenda. To meet the challenges posed through pre-cast concrete Design for Manufacture and Assembly (DfMA), including early scope definition and value capture, the effectiveness of design integration has never been so crucial to the success of a project. Although a number of studies have looked at improving design integration in offsite manufacture, they have primarily assessed the philosophy and processes. This study seeks to delve beyond the process and philosophy and tackle the people factors; the third level of the 4P hierarchy, as presented by the Toyota Motor Corporation, as an implementation strategy for new systems. Therefore, the aim of the research is to determine how to improve design integration between the structural designer and the manufacturer of pre-cast concrete building elements on infrastructure projects. Can the design integration be a pre-determined prescribed product or is it an agile service?

The research methodology used a sequential mixed method approach through a thematic research technique. This utilised a grounded theory approach and Delphi methodology in a case study of a leading UK infrastructure contractor. A detailed literature review, 16 interviews and 3 focus groups totalling 28 industry experts, identified the key factors to successful design integration. The participants represented clients, suppliers, designers and contractors within the industry who are experienced in DfMA delivery. Due to the constraints of the research, results should be assessed against their context. The influencing factors, highlighted in the analysis, show a close correlation against the wider published literature. This is focused around 5 key factors: collaboration, communication, behaviour, leadership and environment. Additionally, the overwhelming critical factor to be achieved and maintained through design was trust.

The research concludes that to build and maintain trust the 5 key elements to be managed are: facilitation, value definition, project start up, empowerment and engagement. These elements aim to establish a founding culture and open collaboration on a project. They are also regularly associated with successful projects in the past. The thesis provides recommended sub factors that aid the delivery mechanism and can ultimately be embedded within the existing DfMA delivery process. These sub factors are graphically presented and aligned in chronological order; responsibilities are highlighted to both the facilitator and stakeholders of the process. Conclusively, design integration requires a dynamic service that must be led and actively cared for by the facilitator throughout the duration of the project. Furthermore, it is suggested that future research should be undertaken to look at continuous improvement and implementation strategies for people factors in the DfMA process.

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