

## Managing Project Complexity in Construction Projects: The way Forward

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Numerous studies have attempted to explain project complexity by exploring the various approaches adopted by researchers [1,2]. The theoretical perspective of project complexity; and the “actuality” of complexity within construction projects has been investigated in the literature reviewed, highlighting the lack of consensus on the subject matter [3]. According to Baccarini [4] complexity is one of the critical project characteristics that determine appropriate actions to result in successful project outcomes, with construction projects continuously displaying higher levels of complexity since the mid-1940's. Many other researchers supported Baccarini's [4] view that project success is dependent on the complexity of a project, having a direct effect on the overall project performance [1,5,6]. Evidently, much of the research produced to date by the construction community has failed to consider the application of lean construction as a way to improve project performance by managing project complexity, ensuring the successful delivery of construction projects. Research undertaken by Smith et al [7] and Bhasin [8] supported this view, noting that the application of lean is what needs to happen for successful project delivery.

In recent years, an increasing amount of research has been undertaken in relation to the subject of project complexity [3]. When evaluating the issue of project complexity, researchers predominately focused on the core platforms of simple project complexity classification and complex systems theory [9]. Azim et al. [3] recognised a lack of agreement among researchers in relation to the definition of complexity. This observation was supported by Xia and Chan [2] who writes that project complexity has not been clearly defined. The only definition of complexity utmost acknowledged by researchers was that of the Oxford English Dictionary, which defined complexity as “*consisting of many different and connected parts*” and “*not easy to understand, complicated or intricate*” [3]. As a multi-dimensional concept, defining construction project complexity is incomprehensible. A recent study by Azim et al. [3] obtained several varying definitions of project complexity, with participant responses ranging from; a variety of people in terms of skills and experience, to a multidisciplinary, multi-national, multi-site and a lot of stakeholders. In review of the findings, Azim et al. [3] identified a direct link between project complexity and ‘people, products and processes’. Azim et al. [3] paper however would have been much more useful, had the authors not failed to consider the implementation of lean tools and techniques in managing people, products and processes of the project environment, which as acknowledged by Winter et al. [10] would subsequently reduce project complexity.

Wheeler [11] suggested that difficulties tend to surface throughout the project duration where the project is initially ill-defined. It is generally the negotiation and consensus building to overcome these difficulties, which result in the project being classified as complex. Dombkins [12] supported Wheeler's [11] assessment, recognising complexity in projects as the unattainable act to undertake accurate detailed long-term planning. It must be noted; that the findings put forth by Wheeler [11] and Dombkins [12] might have been more convincing had they highlighted the need for the construction research community and industry to implement lean construction as a way to overcome project complexity in construction project delivery. Although extensive research has been carried out on project complexity, to date

all existing accounts have failed to provide a single, clear definition of project complexity.

Up to now the literature reviewed of project complexity has focused predominately on the lack of consensus regarding its definition and the complexity typology. From the theoretical approaches explored, it could be argued that managing project complexity through the utilisation of effective lean construction techniques should be fairly straightforward. However failure of the theoretical approaches to address the relationship between theory and practice challenged this supposition. Complexity theory, in relation to construction project delivery has been strongly challenged in recent years by a number of researchers. Xia and Chan [2] pointed out that if construction project complexity was addressed via the behaviour of complex network in complexity theory, then the unpredictable and emergent nature of such a network would potentially inhibit the application of any linear approach. The context of complexity within construction projects has raised the question as to how senior construction managers can go about facing the challenges of project complexity, developing an infrastructure of improved construction project delivery. Lean construction ensures predictable flow, and an enhanced capability to deal with uncertainty and complexity in construction project delivery. Lean methods have been found to improve the dependability of construction project delivery in complex sites, by decomposing the scope of the project into small manageable parts. Construction projects are not intrinsically multifaceted, but because of the challenges encountered during implementation they can become complex. It is crucial that throughout the project life cycle senior managers develop plans and standardise with the purpose of managing complexity in the most efficient way. Incessant communication and coordination during the delivery of a complex construction project facilitates effective management of project complexity.

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