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Examination of Opportunities for Integration of Lean Principles in Construction in Dubai

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Abstract

Lean construction has been shown to have significant potential for impacting construction projects and is receiving increased attention worldwide. The potential for lean implementation in the United Arab Emirates (UAE) has generated interest among construction executives. This interest, however, has translated to limited implementation and to date there have been few projects in the commercial sector employing lean concepts. Previous research performed in Dubai surveyed working professionals on lean construction and evaluated barriers to implementation. This previous research further ranked such barriers in relation to their potential to impede the application of lean principals. To build upon this previous effort, additional research based on available international literature is performed to validate the UAE results and to gain additional insight into the needs of the construction community and the desire for lean implementation. With a greater understanding of the barriers, specific techniques for overcoming institutional resistance are proposed, evaluated and discussed. Future research directions to increase lean awareness are also outlined.

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Keywords: lean construction, construction management, productivity

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1. Introduction

Lean construction principles have been investigated, researched and promoted since the early 1990's to improve the efficiency and effectiveness of construction project delivery through integration of lean manufacturing principles and operations research advancements. The approach focuses on optimizing the flow of production to minimize waste in any form to maximize value. As a result, lean construction thus incorporates many dimensions and techniques that have become synonymous with lean production, such as just-in-time delivery, value-stream mapping and continual process improvement.

Studies throughout the globe have shown that lean construction (LC) principles when applied, prove to have an enormous potential positive impact on the construction process and on the industry as a whole. However, widespread implementation has not yet been realized. Although there are notable examples of success and increased openness to lean and integrated project delivery in western nations, the implementation of lean principles in the United Arab Emirates is still limited. The purpose of this investigation is to understand the barriers to implementation of lean construction principles to identify practical approaches for the implementation and promotion of lean within the UAE construction industry.

2. Background and Literature Review

The development and incorporation of lean principles in construction is generally tied to Kosela's pioneering work on the development of the TFV theory of production to overcome the failure of traditional construction management delivery methods to achieve time, cost and quality objectives [1]. In this approach, **T** refers to the Transformation of materials into a completed facility, **F** refers to the flow of the material through the construction process and **V** refers to value generation and creation, which comes primarily through the elimination of loss and waste in the process. Other early efforts have been summarized by the Deikmann, et. al., [2] in their work for the Construction Industry Institute as follows:

> In addition to Koskela [1], "Ballard, Koskela et al. [2], Picchi [4] and others have proposed lean principles for construction. In addition, many other authors have interpreted individual lean principles for construction. For example, Lane and Woodman [5] investigated the value of flexibility in construction processes, dos Santos, Powell et al. [6] investigated WIP and Lantelme and Formoso [7] and dos Santos [8] studied the value of process transparency. Pull scheduling was studied by dos Santos [8] and Tommelein [9]. The application of the flow concept has been investigated by Ballard [10] and Alves and Formosa [11]. The application of metrics and benchmarking has been considered by Alarcon [12] and Lantelme [13]. The effects of work flow variability have been examined by Tommelein, Riley et al. [14] and Alarcon [12]. Finally, Ballard [10] studied the value of reliable production planning." [2]

From these early efforts, work by Ballard, Howell and others together with the Lean Construction Institute have continued to advance lean construction with the technique facilitated through the Last Planner System for production planning and scheduling. This embodies the core principals of Koskela's approach, lean manufacturing and the Toyota Production System, including: customer focus, culture/people, workplace organization and standardization, waste elimination, continuous process improvement and built-in quality.

Numerous additional literature searches have been performed and are available, either as part of a research studies [16] or as part of clearinghouse web-sites [17]. This research study is particularly interested in lean construction activities in the Middle East with a particular focus on the dynamic construction markets of the United Arab Emirate (UAE). In the available research summaries, there is no focus on lean construction implementation in such rapidly developing nations. Additional research was performed to identify efforts specifically targeting research in the United Arab Emirates and/or barriers to implementation within the region.

The successful implementation process of "Lean Systems" has been challenged by various impediments ever since these systems were introduced into the construction industry brought up from the manufacturing industry. The different features of construction compared to manufacturing are the main drivers behind these impediments [18]. Construction suffers from the complex nature of projects, the fragmentation of the process and subcontracting, non-