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A survey study on industrial construction project supply chain: on time performance and practices of structural steel and pipe spools

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Abstract

Construction material not available for installation cause delays in the construction project supply chain and pose risks to overall project delays. Many researches have studied the supply chain to find the underlining reasons and influencing factors for project delays. Other investigations of the construction project supply chain identify ways to improve the supply chain. The purpose of this study is to determine the current state of construction project supply chain performance with a focus on material on-time availability. A survey of industrial constructors and their suppliers' on-time performance and related supply chain practices was conducted. Structural steel and pipe spools are frequently used in industrial construction projects and were selected as the subject of the survey. This survey was used to obtain a general perspective of the issues associated with the delays so that further surveys and simulations could be performed to pin point specific areas of improvement. This survey of experts in the field was used as a qualitative query to obtain opinions and a feel for the state of the practice in industrial construction supply chain management. For this initial review it is found that there are many possible delays, missing and defective parts, overall 22% for structural steel and 18% for pipe spools. New technologies such as RFID would be a possible way to improve the construction project supply chain process at this level.

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Keywords:

1. Introduction

Construction projects chronically suffers from delays [1,2,3]. Material delay is believed to be one of the major contributing factors [1]. Material management in a traditional construction project environment proves to be both

critical to the success of the project [4] and challenging. Many studies either seek to understand the causes of the delays or find ways to mitigate the risks [5]. However, there few studies that focus on the state of material supplier's on-time performance.

This study is focused on how well the industrial construction industry has been supported by suppliers for on-time-delivery of materials. A survey on the on-time delivery and supply chain management practices of structural steel and pipe spools were conducted. The current state are reported both quantitatively and qualitatively. This study is an initial effort to further identify areas of delays in the industrial construction supply chain process.

2. Background

2.1 Construction delay

According to Abdel-Wahab and Vogl [6], the productivity of the construction industry had not been increasing compared with other industries in the developed world. This stagnation of productivity was studied and determined that it was not due to input of capital and labor but rather how effectively they were combined. The study further recommended further research should be conducted to find ways to improve the productivity. On project level studies, there are many on construction project delays [1,2,3] focused on the causes of delays and cost overruns [7] which lead to poor overall project performance. Material delivery delay has been identified as a reason causing project delays. Assaf and Al-Hejji [1] found that contractors believed that material delay was one of the most severe causes of construction project delays. Analysis on construction delay and finding the root cause is difficult given the number of parties that are potentially contributing to the delay. Claims and law suits ensue when delays cause economic damages. Thus, a potential solution is to determine the best technique to resolve the delay claims, however, this does not address the root cause. [8, 9]. Ala-Risku and Kärkkäinen [10] did recognize that some suppliers had problems with the accuracy of project material delivery which could cause significant difficulties in construction activities. Their research focused on how to handle this problem by developing a new tool to increase inventory visibility. However, there is little information in the literature on studies of the delays as stochastic events as they are and present the current state of the material on time delivery performance for construction projects, especially for industrial construction projects.

2.2 Construction supply chain

The material management of construction supply chain is subject to many constraints and challenges including the one-off nature of contracting, cost competitions among suppliers, competitive bidding, and substituting of products and materials which all make it difficult for contractors to manage. Material management is believed to be one key component of a successful project [4]. Ineffective material management brings delays and disruptions to construction activities and lowers construction productivity [11,12]. Kini [4] pointed out that about 50% to 60% of total costs were for equipment and material in a typical industrial project. According to Kini [4] a typical EPC project should be divided into several distinct stages and the project manager must ensure a material management focus among the project management team in order to achieve a successful project. It is one thing to promote material management focus among the project management team and it is another to hold the suppliers accountable and improve the suppliers' performance to mitigate the construction supply chain uncertainties.

The material management of construction projects suffers from the Bullwhip Effect [13] as being part of the supply chain in the construction industry, the same way many other industries do. The Bullwhip Effect refers to the symptoms that demand information suffers from distortion and magnification as it flows through the supply chain. In terms of material management of construction project, a small delay at the supplier's workshop could end up into a big disruption to the construction process. When materials and equipment that are to be installed on site for the construction project travel from the original manufacturers through the supply chain to the contractor's job site, due to information delay and distortion along the chain they more often than not arrive on site at a time either early or late. The Bullwhip Effect thus provides extra uncertainty and variability into the system causing disruptions to construction work scheduling and actual progress. Practitioners in the construction industry have long become

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