Chapter 28
Critical Risk Path Method: A Risk and Contingency-Driven Model for Construction Procurement in Complex and Dynamic Projects

Chi Iromuanya
Capella University, USA

Kathleen M. Hargiss
Capella University, USA

Caroline Howard
HC Consulting, USA

ABSTRACT

Existing approaches to risk management in construction procurement primarily dwell on strategies designed for commonly identifiable risk factors in typical project environments. Commonly identifiable risk factors would include too early or late material delivery - a condition typically ameliorated by implementing a Just In Time (JIT) plan; inferior construction materials typically mitigated by employing trusted vendors; or ineffective contractors primarily avoided by the use of experienced contractors. The purpose of this paper is to present a coherent model for procurement risk management for construction and infrastructure development projects within the context of dynamic project environments - complex, or chaotic. For the purpose of this study, a critical risk path activity is one in which a delay of activity completion not only leads to project delay, but does so in a manner that may be fatal to project or at best, far greater than the actual delay. The study incorporates observations and theory with practical application for improving initiatives by emergency infrastructure development response organizations such as FEMA (Federal Emergency Management Agency) and USACE (US Army Corps of Engineers) in the United States, the NEMA (National Emergency Management Agency) in Nigeria, or ANDMA (Afghanistan National Disaster Management Authority) etc. This study presents risk response plans aimed at improving the potential occurrence of positive risk aspects while reducing, or eliminating the same for negative risk occurrences. This study explored material, equipment, and skilled labor procurement strategies related to project risk management from the perspectives of scheduling, cost, and quality - three factors often referred to as the triple project constraints. It identified gaps within specific national

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and multinational organizations' approaches, and provided detailed recommendations for process improvements from the procurement management perspective to ensure the potential for successful project outcomes in unstable project conditions.

1. INTRODUCTION

In order for risk planning to be successful, it must be part of the culture of a project managing organization (Lash, 2000). Whereas emergent risks may require ad-hoc solutions, such a reactive approach is not the nature of an integrated risk management plan. For many construction organizations, the greatest risk lies in not creating a culture in which risk management becomes a way of life. The purpose of risk management planning is to increase the probability and impact of positive events, while decreasing the probability and impact of negative events (Clarke & Varma, 1999). Risk management planning is concerned with conducting risk identification, performing risk analyses, planning responses, and ultimately controlling a project.

Projects typically encompass the use of acquired materials and equipment to create valuable objects over time. Project value is engineered into the procurement of materials and equipment and the application of same during a negotiated period and within an agreed cost, while conforming to a given scope and quality. Therefore, value engineering should not be seen or approached as a process of engineering value out of the project by utilizing initially low-cost but ultimately ineffective approaches, rather it should be a robust process of adding value to the project by utilizing effective, even if not efficient mechanisms for supply chain and construction management (Tohidi, 2011). The ultimate goal of value engineering should be the attainment of project success in terms of early project delivery time, within budgeted cost and desired quality, while reducing as much waste as possible.

While Just in Time (JIT) material supply may be appropriate for a lean production environment, or the construction of stock projects in stable project conditions, it may prove extremely expensive in chaotic project environments such as during emergent infrastructure and facility development as in post-Katrina recovery efforts, or the completion of complex facilities. The primary benefit of JIT lies in its low waste nature which reduces the need for discarded or unneeded inventory (Chopra & Sodhi, 2012). The danger of JIT for contingency or complex construction lies in an inability to predict demand, and the slow delivery capability of vendors during periods of emergency. During emergency construction work, productivity is largely a function of effective material supply chain, and not necessarily a function of waste-free efficiency in inventory management. In essence a less than efficient but largely effective supply chain is better suited to emergency or complex work where life safety and early completion are primary concerns.

2. BACKGROUND

The critical path through a schedule of logically and sequentially connected activities is the longest path through the network of project activities. This longest path known as the critical path also represents the shortest time it would take to complete the project (Kerzner, 2013). Any delay on activities on this longest path will cause delay on the project delivery date if nothing is done to recover the lost time. Most planners want to determine which critical activities have the most impact on schedule delays. The answer to this

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