

# Chapter 31

## Analysis of Risk and Reliability in Project Delivery Methods

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### ABSTRACT

*Risk and reliability are two main factors that must be studied in order to measure the successful rate of a project. As a result, innovative project delivery methods have been proposed to mitigate the risk and improve reliability of a project. The intent of this study is to compare the use of the Analytical Hierarchical Process (AHP) and fuzzy AHP for decisions surrounding the early stages of construction projects based on risk and reliability measures. Financial risk is especially high during the early design stages of a project due to the unknown obstacles that will follow. The case study uses the selection of a project delivery method as an example, and provides a sample project to highlight the project-specific variability of the multi-criteria decision analysis.*

### INTRODUCTION

In feasibility study of a project that is planned and executed in industries such as construction industry, aerospace, Defense, computer networking, telecommunications, software development, etc., risk analysis and reliability are two main components (Sandy et al., 2005; Santos & Cabral, 2005; Seyedhoseini et al., 2007). Literature pertaining

to projects can be classified to project management, civil engineering, software engineering, enterprise systems, and public application. For example, because of growth in enterprise ERP, Lefley, and Sarkis (2005) applied a model to the evaluation of strategic information technology projects. As a result, the enterprise managers not only can improve the processes but also can achieve the project goals in the enterprise. Orłowski and

Kowalczyk (2006) developed a fuzzy model for software project management in an enterprise that mitigated the problems involved in software project management regarding the planning and control of processes and project teams. Soja and Put (2007) studied the characteristics of an ERP in order to plan for successful implementation a project in an enterprise. Su et al., (2008) studied product customization projects. They proposed a product customization method which is a life-cycle-oriented project. Chandrakumar and Parthasarathy, (2012) proposed a structured process for securing the software project such as integrated packaged software ERP. Argyropoulou et al., (2009) developed a framework for evaluating an ERP project that takes into account only the performance measures. Boonstra (2009) explored the management and stakeholders strategies for participation in enterprise information system projects. This study proposed to apply identification, analysis and intervention techniques for the successfulness of enterprise information system implementations. Also, Chen and Wang, (2012) developed an integrated project management model is designed for facilitating knowledge learning.

In construction industry, a project is- and always will be- one of the riskiest projects in the world. From unknown sub-surface conditions to inclement weather to indecisive owners, the only certainty is that plans will change. And generally, change is expensive. Over the past century, the construction industry has evolved to accommodate this financial risk through collaboration. More specifically, innovative project delivery methods have been established to divide the risk, authority and responsibility of a project among the contractor, architect and owner.

However, there is no clear winner among these new project delivery methods, as they all have different strengths and weaknesses. Selecting a project delivery method is a multi-criteria decision that demands a thorough analysis. Each project

has its own unique characteristics and every owner has their own unique desires. Goldfrey, (1996) investigated construction project risks, the ways to minimize, share, and transfer the risk. Del Cano and Del la Cruz (2002) developed a hierarchically structured, flexible, and generic methodology for construction projects Walewski, (2003) demonstrated a structured risk identification, analysis, and mitigation that moderates the risks associated with international construction projects. Wei, (2004) proposed an effective and systematic framework for quantitatively identifying, evaluating, and responding to risk in construction projects.

The Analytical Hierarchical Process (AHP) is a popular method to approach multi-criteria decisions. In the selection of project delivery, however, the problem statement suffers from a plethora of unknowns. By nature, it's a decision that must be made before many critical answers can be determined during the detailed design has been completed. Thus, the fuzzy AHP is another multi-criteria decision analysis method that can account for this uncertainty.

## **PROBLEM STATEMENT**

In 2011, Los Angeles World Airports (LAWA) worked through the planning stage of a new passenger processing facility at Los Angeles International Airport (LAX). The facility was needed to accommodate the demands of airlines in Terminals 1 and 2 for queuing, screening, and processing of passengers and baggage. A team of architects carefully defined the overall needs and identified the performance criteria of the proposed new building (equivalent to a 30% design package). At the end of the Planning Stage, the team needed to recommend a project delivery method moving forward. By using popular analytical methods, this study quantifies the advantages of the different delivery methods to select the best option for this particular project.

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