

## Chapter 5

# Lean and Total Quality Management in Civil Engineering

### ABSTRACT

*The aim of this chapter is to examine the utilization of total quality management (TQM), ISO 9000, and Lean concepts in the management processes of civil engineering consulting firms. The history of management theory and the existing literature related to total quality management, ISO 9000, and Lean concepts as applied to the civil engineering profession were reviewed. Also, the practical application of these concepts in civil engineering firms' operations and the extent that academic courses in these topics are offered were analyzed. The study is based on internet research and interviews with civil engineering managers and college professors. The results show that while the literature strongly endorses the utilization of these management concepts, the actual use is little known in the professional business of civil engineering. Also, in general, undergraduate civil engineering academic programs in the United States do not offer specific courses, which cover these concepts in their curriculums.*

### INTRODUCTION

The issue is while TQM, ISO 9000 and Lean concepts have been suggested as a means to the improvement of civil engineering consulting firm operations; it appears these concepts are not being adopted by industry or academia. The purpose of this research is to determine if and possibly why the civil

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engineering consulting profession is not, by practical application, adopting some form of TQM, ISO 9000 or Lean concept in management processes and what suggestions can be made to facilitate a change in the profession to consider or adopt these concepts.

Total Quality Management (TQM) has proven itself in the past to facilitate overall improvement of manufacturing firm process operations in many aspects and has more recently been recommended for application to engineering, design and construction firms. ISO 9000 and Lean philosophies are also suggested as ways civil engineering consulting firms can improve their organizations. Civil engineering has been especially considered relevant to Lean construction as applied to design and construction firms. This correlation of civil engineering to Lean construction is due to construction and civil engineering involving generally very similar projects, with civil engineering be more closely aligned with design, while construction with actual building processes. TQM, ISO 9000, and Lean concepts, which have been suggested as applicable to the civil engineering profession, have somewhat evolved, as have management philosophies over time.

Deming, Crosby, Juran and other management theory pioneers envisioned TQM initially as a means to improve manufacturing processes in Japan in the 1950's as the automobile industry developed internationally. The Motorola Corporation followed the initiation of TQM by introducing the concept Six Sigma, a philosophy aimed toward reducing defects in high volume manufacturing to a minimum in the mid-eighties. ISO 9000 followed in the late eighties and was created to establish a set of international standards by which firms could benchmark their abilities in comparison to other companies around the world (Davis and Goestch, 2006).

Lean theory, initially described as Just-in-Time manufacturing, essentially arose from the Toyota Corporation in the 90's through the work of Eiji Toyoda and Taiichi Ohno where they identified wastes in the manufacturing processes at Toyota Motor Corporation. They developed a system of production that reduced waste, however Lean theory was also later recognized as a fundamental business philosophy (Forbes and Ahmed, 2010). Lean theory was first recognized by Lauri Koskela as a new philosophy that could be applied to the construction industry and was later developed further by Glen Ballard and Greg Howell who coined the term "Lean Construction", they also initiated the Lean Construction Institute and pioneered the Last Planner System, all in management theory, to maximize value and minimize waste

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