A structural equation model and a statistical investigation of lean-based quality and productivity improvement

Abstract

In response to rapid expansion rate of technological change and information technology, and increasing customer demands, Next Generation Manufacturing Systems (NGMS) and Fit Production Systems (FPS) are emerged. Lean Production (LP) covers a wide range of production concepts and philosophies that can be classified as NGMS and/or FPS. In this paper, LP is introduced, defined, and reviewed, important aspects when implementing such production strategy is addressed, and practices of LP are mapped into different impact areas of production, among these "Quality and Productivity Improvement (QPI)" impact area. QPI may involve eight lean practices these are: Variability Reduction (VR), Visual Control (VC), Poka Yoke (PY), Quality at the Source (QS), Kaizen (K), Five S (5S), Root Cause Analysis (RCA), and Total Quality Management (TQM). The purpose of this article is to provide bottomless insights into the adoption of these eight constructs and their effect on lean based QPI model. A Structural Equation Model (SME) is constructed. Hypotheses are proposed, Five-Points-Likert scale questionnaire is distributed by hand to 450 different firms. Feedback from 300 firms is collected then statistically analyzed using SPSS 15.0, AMOS 19.0.0, and LISREL 8.8 software. Implementation level (I %) of the eight lean practices in the selected sample is evaluated, multicollinearity, reliability and internal correlations matrix to insure content validity, consistency, and construct validity respectively are applied, fit indices are derived, one way ANOVA analysis is performed, and finally hypothesized causal relationships between model constructs are concluded, the results provide strong evidence that all the considered lean practices has a positive effect on lean-based QPI model, these findings can be fruitfully utilized to cope over the challenges facing the implementations of LP production strategy in industry.