

PhD Thesis

HOLISTIC ROOT CAUSE ANALYSIS APPLIED TO SIX SIGMA

Abstract

This thesis describes research into a novel methodology for Holistic Root Cause Analysis for the Analyze-phase of the Six Sigma. The methodology, namely Root Cause Systemic Analysis (RCSA), uses System Dynamics to assist in acquiring a comprehensive understanding of the problem-causation incorporating Systems Thinking and simulation analysis. RCSA will be appropriate for finding the ‘common-cause’ of problems. The research has shown that the effective use of Six Sigma for problem-solving in complex systems has been hampered in practice due to a reductionist approach adopted by the existing tools for Root Cause Analysis.

The RCSA methodology encompasses three phases. The First Phase, Problem Conceptualization, helps disclose the non-linear causal mechanism and the interrelationship amongst wide-ranging possible causes of the problem. These include both ‘hard’ and ‘soft’ factors to conceptualize the problem as a system in its entirety. The Second Phase, Problem Modeling, provides the means of simulation for Holistic Root Cause Analysis. The Third Phase, Problem Understanding, assists in the understanding of the problem-causation and guides problem-solvers towards the ‘common-cause’ of the problem with simulation analysis. Behavior modes arising from simulation of the problem modeled are observed to analyze these inherent root causes of the problem.

In developing and validating RCSA, the research process followed through all the steps in the Constructive Research Approach (CRA). The results show that the devised methodology was successfully developed, tested, and evaluated within the case study company, a fertilizer manufacturer located in Southeast Asia, helping them solve a recurrent problem in maintenance.

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