

ABSTRACT

Effective Supply Chain Management (SCM) practices results in a variety of advantages such as increased customer value, increased profitability, reduced cycle times and less inventory levels. Companies can no longer focus on optimizing their own manufacturing operations to the exclusion of their suppliers' and customers' operations. Supply Chain Performance Measures (SCPM) serve as an indicator of how well the Supply Chain (SC) system is functioning. Measuring SC performance can facilitate a greater understanding of the SC and improve its overall performance. Therefore, there is an emerging requirement to focus on the performance measurement of the SC in which company is a partner. Literature survey on Supply Chain Performance Measurement Systems (SCPMS) indicates that there are gaps still existing and significant amount of research is necessary to develop and implement effective performance measurement systems.

The present research examines existing performance measurement frameworks in SCs, identifies strengths and gaps in order to develop appropriate models for supply chain performance measurement. The comparative study of common frameworks and models for performance measurement helped to identify research gaps and focus of research agenda. Rational use of operations research techniques, heuristics and simulation techniques have been incorporated with existing highly cited frameworks of performance measurement. Motivation for the present study is summarized as: i. SC performance is critical to effectiveness of SCs; ii. Measures spanning entire SC do not exist; there is requirement to go beyond internal matrix and take an SC perspective; iii. Existing measures usually have little to do with SC strategy and objectives, the measures may even conflict with objectives and result in inefficiencies; iv. Measurements encourage desired behaviours; the goal of encouraging desired organizational behaviour across SCs; v. Requirement to align activities / process with strategy and SC goals; vi. Benefit of incorporating technology, Operations Research techniques and heuristics in performance measurement systems.

A detailed literature review formed the foundation for the research. In addition to literature review, expert opinion in the form of Delphi method and exploratory are also part of the study. Appropriate tools have been identified for performance measurement model development. Analytic Hierarchy Process (AHP), Fuzzy AHP, Data Envelopment Analysis (DEA), Balanced

Score Card (BSC) and Performance Prism (PP) are the major tools and methodologies used in the study.

AHP is a general problem-solving method that is useful in making complex decisions (e.g., multi criteria decisions) based on variables that do not have exact numerical consequences. The present study incorporates AHP along with BSC and PP in order to align performance measures with strategic objectives. AHP is also employed in the framework for flexibility performance measurement and sustainability aspects in SC.

Limitation of AHP approach is that it is incapable of handling inherent subjectivity and ambiguity associated with mapping of one's perception to an exact number. This led to development of fuzzy AHP. Based on Extent Analysis Method of Fuzzy AHP a tool is developed to measure flexibility in a SC.

DEA is a performance measurement technique used for determining the relative efficiency of a set of comparable business called Decision Making Units (DMU). The efficiency score computed by DEA is a numerical value that describes a system's relative efficiency in terms of inputs and outputs. In the present research, DEA is employed for benchmarking flexibility in SCs and in the performance measurement of maintenance aspects in a SC.

BSC took an innovative approach to performance measurement, which complements financial measures of past performance with measures of the drivers of future performance. The present research provides a framework which overcomes the limitations of BSC by providing a mathematical and logical relationship within the scorecard criteria by integrating AHP with modified BSC. The Performance Prism (PP) takes account of the two-way relationships between a business organization and its stakeholders. A performance measurement framework incorporating PP integrated with AHP is proposed in the present study which helps align resource allocation with strategic objectives.

Performance measurement frameworks for different aspects of a SC are presented as part of the research. They are: i. Performance measurement framework for of strategic planning and resource deployment in SCs using AHP and BSC; ii. Performance Measurement Framework for Strategic Alignment in Supply Chains using AHP and Performance Prism; iii. Framework for SC Flexibility Performance Measurement using Fuzzy AHP; iv. Measurement of Flexibility and its Benchmarking using DEA in SCs; v. Taxonomy and framework for Flexibility Performance Measures; vi. A methodology to priorities the contribution of performance

attributes; vii. Framework for sustainability performance measurement in SCs; and viii. Performance Measurement Framework for Reverse SC (Maintenance Management)

Based on an exploratory survey, an analysis of performance measurement practices of Indian SCs is part of the research. The study indicates a departure from previous surveys on Indian SCs. Many organizations started using balanced measures in addition to financial performance measures. The industry sectoral differences are diminishing in SC wide performance measures. The survey identified objectives for using SCPMS in Indian organizations and identified, analyzed and recorded frameworks and tools employed in Indian SCs.

The performance measurement frameworks developed through this research can facilitate improved supply chain management capabilities to organizations. The study also presents suggestions for future research and presents an agenda. The contribution of the research benefits practitioners of SC, researchers, academicians and students of SCM. The research findings add to the body of knowledge and fills gaps in SC performance management theory and practice.

Key words: Supply Chain Performance Measurement, Data Envelopment Analysis (DEA), Analytic Hierarchy Process (AHP), Fuzzy AHP, Performance Prism.