A STUDY ON WIDESPREAD ADOPTION OF LEAN MANUFACTURING PRACTICES IN ENGINEERING GOODS MANUFACTURING FIRMS

ABSTRACT

Lean manufacturing is a leading manufacturing paradigm with a systematic approach used to identify and eliminate waste by focusing on production costs, product quality and delivery, and worker involvement. The focus of lean manufacturing is to identify and eliminate waste (non-value adding activities) by implementing lean practices and make the product flow at the pull of the customer in pursuit of perfection. Today, lean manufacturing has become an increasingly important topic for manufacturing companies as they try to find ways to compete more effectively against global competition.

Studies conducted during the past decade on lean implementation, found that the adoption of lean practices in manufacturing firms in India are very much lagging when compared to global counterparts. Companies fail in implementing lean practices due to selection of wrong tools and implementation sequence. There is always pressure on the companies to produce faster, better and be less expensive with existing resources. This can be achieved only through adoption of lean manufacturing practices. As companies try to implement lean, to respond to competitive pressure, they tend to be one dimensional in their approach. Firms cannot get the full benefit of lean adoption by neglecting other areas of manufacturing which will lead to failure in lean implementation. It is clear that a more holistic approach is required for successful adoption of lean practices. Therefore, it was decided that a research with an inclusion of multi-domain lean practices will facilitate firms opting for wider adoption of lean manufacturing practices.
This research aims at the study of adoption of lean practices in a widespread-balanced approach. Previous researches have not aimed at implementing lean practices in a widespread-balanced manner. This is the first study attempting to prove that a lean implementation with a balanced approach in an organisation has an influence on its operational benefits and better firm’s performance. Widespread lean adoption is the use of lean tools and techniques across the organisation to the degree in which it yields benefits. Lean practices are not just for production management, but other areas like production and inventory management, total quality management, total organisational buy-in need attention for the use of lean manufacturing techniques. The implementation process requires a lean transformation framework at the enterprise and functional levels. Once the transformation takes place maximum benefits could be achieved with contribution from the employees, suppliers and the management.

Industries play a crucial role in India’s economic development. Engineering is the largest among industrial sectors in India. It can be broadly categorized into two segments: heavy engineering and light engineering. The major end-user industries for heavy engineering goods are power, infrastructure, steel, cement, petrochemicals, oil and gas, refineries, fertilizers, mining, railways, automobiles, and textiles. Light engineering goods are essentially used as inputs by the heavy engineering industry. Importance of engineering industry in India can be gauged from the fact that it employs over 3 million people and accounts for nearly one-third each of productive capital, value added and output in the organized sector that contributes substantially to both the production and exports of engineering goods. The engineering goods sector is regarded by most economists as the engine of economic growth. Furthermore, it is a known fact that manufacturing industry depends heavily upon the engineering goods manufacturing firms. Engineering goods are defined to include main categories: Switchgears and Electrical items, Pumps and electric motors, and manufactured goods given in SIC Codes 3613 and 3621.
The aim of this study is to evolve a sector-specific Lean Manufacturing Practices (LMP) with special reference to engineering goods manufacturing firms in South India, duly validated to show how it would lead to higher volumes of production through minimum use of resources and thus achieve competitive advantage through operational benefits.

This research uses key lean principles developed through review of previous studies that constitute tools of lean practices. These principles provides an opportunity for widespread adoption of lean manufacturing practices in engineering goods manufacturing firms and appraises the leanness adopted by them. This would further help firms to identify the areas of improvement across the organization.

Firms can achieve widespread lean by implementing the lean principles suggested under four domains viz., Total Organizational Buy-in (TOB), Total Quality Management (TQM), Production and Inventory Management (PIM) and Lean Manufacturing Techniques (LMT) that also helps to achieve a balanced adoption of lean practices. The four lean domain constructs classify firms into Widespread Lean Firm (WLF) and Limited Lean Firm (LLF) based on the extent of its implementation by the firms.

A questionnaire was constructed with the aim to assess the level of widespread lean adoption, which consists 3 parts. The first part contains a set of questions to understand the demographic details about the firm, the core second part contains 7 constructs with 84 items, and the final third part contains items relating to measurement of organizational benefits and performance. A total of 750 manufacturing firms were selected at random, in which 168 complete filled-in forms were received, corresponding to a response rate of 22.4 per cent. The firms involved in manufacturing transformers, switchgear and motor control gear equipment, household electrical machines and appliances, electric motors, pumps, valves, electrical machinery, and auto components that have similar type of batch production process were considered for the study.
There are three main areas of contributions in this research. First, the lean principles developed through review of previous studies constitute tools of lean practices for engineering goods manufacturing firms. These lean principles provide an opportunity for widespread adoption of lean manufacturing practices in engineering goods manufacturing firms. This will also help firms to identify the areas where it lags in implementing lean and identifying ways to improve.

The second major contribution of this research is adoption of lean practices in a widespread-balanced approach. Previous researches have not aimed at studying implementation of lean manufacturing practices using a balanced approach. Hence this study attempts to prove that implementation of lean manufacturing practices with a balanced approach has a beneficial on operational benefits and leading to better firm’s performance. The widespread lean practices can be achieved by implementing the suggested four domains of lean principles measured in terms of Total Organizational Buy-in (TOB), Total Quality Management (TQM), Production and Inventory Management (PIM) and Lean Manufacturing Techniques (LMT).

Finally, the lean principles developed provide a basis for classifying the firms into Widespread Lean Firm (WLF) and Limited Lean Firm (LLF). Future research could be taken-up for using the above approach in different sectors of manufacturing with suitable modifications.

Statistical tools were used to validate the constructs and data. The reliability analysis using SPSS software and structural equation modeling using PLS path modeling software were also employed to analyze the data. The cluster analysis provided a clear indication in difference in the levels of scores in implementing lean principles by the firms. The cluster analysis classified firms into two firm groups. Firms with high level of scores on all the four lean principle domains were categorized as widespread lean firms. The second group firms with relatively low level of scores were categorized as limited lean firms. Correlation analysis shows that the lean principle domains have strong correlation between them. Outcome of
the ANOVA results support the proposed hypotheses that widespread adoption lean manufacturing practices influence the firms to attain significant improvement in the firms performance. Finally, a Lean Enterprise Model was developed using Partial Least Square Path Analysis using VisualPLS software. The model proves that the firms those adopt all the four lean principle domains were able to achieve operational benefits and organisational performance which paves way to achieve competitive advantage. The study provides a direction for further research to assess the level of balance a firm should possess in each lean business principle and on which it is deficient.