CHAPTER 2

REVIEW OF LITERATURE AND RESEARCH METHODOLOGY

2.1 INTRODUCTION

This research aims at adoption of lean manufacturing practices in a widespread-balanced approach in engineering goods manufacturing firms.

The review of literature helped to understand how past studies viewed lean practices and its relationship in achieving operational benefits. Reviews of previous researches confirm that many studies have been carried-out on lean practices and its adoption in various sectors of manufacturing. But, when it comes to Indian industries, only few studies were carried out on lean manufacturing practices and its implementation. Surprisingly, no study was undertaken focusing the engineering goods manufacturing sector in India. Further, with the discussions made with the practicing managers in industry, it was understood that lean manufacturing practices were implemented focusing only on a few lean techniques along with quality management system. Lean practices was implemented with no inclusion of other domain tools such as employee participation, supplier co-ordination, organisational culture, inventory management, employee empowerment, production smoothing, and perhaps the most important component of management’s view towards lean implementation.

2.2 PREVIOUS RESEARCHES

Akin O (2001) states that lean manufacturing philosophy is pivoted on designing a manufacturing system that perfectly blends together the fundamentals of minimizing cost and maximizing profit. These fundamentals are Man, Material and Machines - the 3Ms of manufacturing. A well balanced 3M results in maximum
utilization of man - skilled and unskilled, optimal module size - cellular plant, smooth traffic flow - of materials, man, automotive, minimum total manufacturing cost - of products produced, reduce investment, reduce labor requirement, increase return on net asset. A balanced manufacturing system that will maximize the 3M resources can be achieved by balanced adoption of lean manufacturing practices.

Pius Achanga, Shebab, and Rajkumar Roy (2006) in their results found that the idea of applying lean manufacturing has not been adopted by meaningful number of SMEs with any conviction. They suggest that future work should lead to a wider spectrum of SMEs in order to derive a more concrete multi-variant analysis on the relations between independently and owner-managed SMEs. The work emphasized on the need to consider how to promote the tangible benefits of Lean Manufacturing, perhaps calling for innovative dissemination actions, and how to provide tools and other support to manage and minimize the implementation risks. The study recommended innovative strategies to provide suitable tools that minimize risk.

T. Melton (2005) expresses that lean is a revolution and states that lean is not just about using tools, or changing a few steps in the manufacturing processes but it is about the complete change of the businesses, about how the supply chain operates and how the directors direct, how the managers manage, how employees and people go about their daily work.

Bob Montgomery (2007) opined that the challenge of lean in future requires re-inventing the enterprise, leading the enterprise to new ways of doing things, changing the culture, achieving exemplary performance, surviving competition, and growing through perceived value by the customers. The paper emphasized the need for use of a new approach of lean implementation for organizational performance.

Chan, K (1993) in his findings concluded that world-class companies realized the need to approach manufacturing in a balanced perspective, placing equal emphasis on structural, infrastructural, and integrating elements of strategy.
There is misconceptions that lean cannot be applied in all industries and it works well within the automotive industry. Soriano-Meier, Horacio, Forrester, and Paul L (2002) clarified the concept of lean manufacturing and what it comprises. The results of their study confirmed that lean production can be applied in any type of industry. Further it recommends the need for more research to make use of the tool in different industries in order to be able to clarify the controversy over lean manufacturing.

Cocolicchio (2008) and Husby (2007), from their viewpoint states that Leanness should not be viewed in the narrow sense of few tools and techniques, but rather as a holistic approach that transcends the boundaries of the shop floor and consequently looking at the entire organisation along with the management of the company.

Haskin (2010), doubts that organisations have little chance of implementing lean manufacturing practices unless they have paid at least equal attention to creating the right culture, and the conditions and circumstances which can become the foundation for implementing change.

Ronald M Becker (2001), in his observation states that lean implementation requires a commitment and support by management, and participation of all the personnel within the organization to be successful.

(Hines at el., 2004) in his study observes that in many companies the major focus of lean implementation is still the shop floor and their research for competitive advantage has yet to rely on the more recent lean integrative approaches.

(Beer, 2003) in his study recommends firms to focus on improving processes to a more holistic, systems view of improving the overall business.
2.2.1 Studies in Indian Industries

Nitin Upadhye, S. G. Deshmukh, and Suresh Garg (2010), observes that while lean manufacturing is delivering sustainable competitive advantage to organizations as a change and improvement strategy, it has not been successfully implemented by Indian industries at large. Most published work provides significant proofs of implementation of lean manufacturing system in west, but Indian cases are very few. Their research paper concludes that implementation of lean principles requires a solid groundwork, proper understanding of the concept, and culture of team working, employee motivation and participation and above all the willingness and firm commitment of top management. A motivated and well-trained workforce under the leadership of a committed management produces better results.

Bhim Singh, S.K. Garg, S.K. Sharma, Chandandeep Grewal (2010), in their research in a production industry located in Punjab, India by applying value stream mapping found benefits of lean practices in terms of reduction in WIP inventory by 89.47 per cent, finished goods inventory by 17.85 per cent, product lead time by 83.14 per cent, processing time by 12.62 per cent, manpower required by 30 per cent and output per operator is increased by 42.86 percent.

Gulshan Chauhan and T.P. Singh (2011), in their study suggest more research particularly in the aspect of interplay of labour and machines flexibilities to achieve lean manufacturing.

Considering the importance of lean implementation in India, the Government of India has initiated 'Lean Manufacturing Scheme', brought by the Japanese, for the Micro, Small and Medium Enterprise (MSMEs) units to increase operational efficiency and manufacturing competitiveness of the sector. The scheme will enhance the manufacturing competitiveness of MSMEs by applying lean manufacturing techniques. (HT Media Ltd, 2009).
2.3 CONTRIBUTIONS OF RESEARCH

There are three main areas of contributions in this research. First, the research uses the key lean principles developed through review of previous studies that constitute tools of lean practices. These lean principles provide an opportunity for widespread adoption of lean manufacturing practices in engineering goods manufacturing firms and appraises the lean practices adopted by them. This will also help firms to identify the areas of improvement across the organization.

The second major contribution of this research is adoption of lean practices in a widespread-balanced approach. Previous researches have not aimed at studying the implementation of lean manufacturing practices in a balanced manner. This is the first study attempting to prove that lean implementation with a balanced approach has an influence on operational benefits and 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) that leads to widespread adoption of lean practices.

Finally, the research provides four measures of lean principles that classify firms into Widespread Lean Firm (WLF) and Limited Lean Firm (LLF). The lean principles developed, and extent use of these principles by firms will provide a basis for classifying firms as WLF and LLF. Future research could be taken-up for different sectors of manufacturing with suitable modifications.

2.4 RESEARCH DESIGN AND METHODOLOGY

The research study aims at describing a particular phenomenon and is conclusive in nature. The most appropriate design that best addresses the research aim and objectives of the study, a descriptive research is considered more appropriate.
Due importance is given in sample selection, calculation of sample size and developing the research instrument. The research process adopted is shown in Fig: 2.1.

2.4.1 Sampling Technique

The population was defined as “Engineering Goods Manufacturing firms” in the state of Tamilnadu located in Southern part of India. Firms with employee size of more than 100 were taken for the study which includes firms manufacturing pumps and electric motors, switchgears and electrical items, motor control gear equipment, household electrical machines and appliances, valves, auto components and related product. These firms have batch type production process for manufacturing the products. A stratified random sampling method was used by selecting 750 firms stratified under the type of products manufactured. The sampling frame comprises the registered members of Confederation of Indian Industries, CII - South Zone.

2.4.2 Research Instrument

A measuring instrument was developed in a questionnaire format designed to measure the lean principles for widespread adoption of lean manufacturing practices in engineering goods manufacturing firms. Through a comprehensive review of literature in the field, items for the measuring instrument were developed. The questionnaire was constructed with the aim to assess the level of widespread lean adoption, which consists 3 parts (Appendix 1). The first part contains a set of questions to understand the demographic details about the company, the core second part contains 7 constructs and 84 items, and the final third part contains items relating to measurement of organizational benefits and performance.

2.4.3 Sample Size

750 firms were selected at random those stratified under the type of products manufactured from the registered members’ directory of Confederation of Indian Industries, CII. Out of which 168 complete filled-in forms were received corresponding to a response rate of 22.4 per cent.
2.4.4 Data Collection

A survey was conducted by sending questionnaires by postal mail addressed to Vice-Presidents or General Managers of companies. Short direct interviews through appointments, was carried out for companies those who were reluctant in providing financial information.

2.5 DATA SOURCES

2.5.1 Primary Data

With the help of literature review from various journals, a research instrument was built to derive a lean enterprise model with a five point rating scale. Constructs with five-point Likert scale was used in the questionnaire for each of the items for the respondents to indicate the degree of adoption of lean practices. For the degree of lean tools and techniques implemented a five-point rating scale was given in the order, 1-Not implemented, 2-Just started implementing, 3-Implemented partially, 4-Implemented well, and 5-Achieved Full implementation. Likert scale was also used with scaling from strongly agree to strongly disagree for other construct measurements.

2.5.2 Secondary data

To obtain the opinion and views of industry experts’ personnel interviews was conducted with prior appointments. To gather information relating to industry practices and performance, data was collected from research journals, websites, newspaper articles, industry reports and association in-house journals and magazines. This largely helped to gaining better insight about industry scenario as a whole.
2.6 PILOT SURVEY

The objective of the pilot study is to ensure the scale reliability and item purification. A pilot study was carried-out prior to the large scale data study. The research instrument accompanied with a covering letter was sent to manufacturing
firms address to the Vice-Presidents, Managers that includes Plant Managers, General Managers and Middle-level Managers working in Production and Operations Management discipline. As an initial despatch, questionnaires with reply cover were mailed to 150 manufacturing firms. Out of which 33 complete filled-in questionnaires were received within a months time and 15 more questionnaire was received after sending a reminder. 16 forms were collected directly from the firms. A total of 64 forms was collected and were used for further analysis. A reliability test was carried out for the pilot data collected. The Cronbach alpha that takes a value between 0 and 1 was tested for item reliability. Alpha values above 0.60 are acceptable for exploratory studies (Nunnally, 1978). For item purification, Corrected Item to Total Correlation (CITC) values was calculated. Items with more than 0.30 CITC values are considered for the study. The Cronbach alpha values and CITC values were arrived for all the items and based on the results few items were dropped. In certain cases, were CITC values were slightly less than 0.30 but still considered important for the study was reframed with few modification and considered for the study. Further, academicians and experts in operations management was contacted to confirm the item consideration and finalize the questionnaire. A modified final version of the questionnaire was designed for large-scale data collection.

2.7 STATISTICAL TOOLS USED FOR ANALYSIS

The primary data collected was processed for analysis to perform the testing of research hypotheses.

(i) Descriptive statistics was performed to find the mean scores and standard deviation for the items and constructs.

(ii) Correlations among the four lean domain constructs.

(iii) Chi-Square test was performed to test whether firms differ on growth rate based on adoption of lean manufacturing practices.
(iv) The constructs reliability and validity were tested for arriving acceptable Cronbach’s alpha values and CITC values.

(v) Firms were classified as Widespread-Lean Firms (WLF) and Limited Lean Firms (LLF) based on the score results obtained using cluster analysis.

(vi) Classification of lean type firms was validated using discriminant analysis.

(vii) One-way ANOVA and chi-square tests were carried-out to test the set hypotheses.

(viii) A theoretical framework was developed for successful adoption of lean manufacturing practices based on the results obtained.

(ix) Finally, a structural equation model was developed to establish the components under various constructs that determines the widespread adoption of firms (dependant variable) to achieve a competitive advantage. PLS path modelling structural equation technique used to confirm the validity of the constructs and the path postulated in the model (Appendix 4).

2.8 LAYOUT OF THE THESIS

The thesis consists of five chapters in the order shown in Fig. 2.2. The first chapter provides an overview of research study that includes sub topics such as research motivation, research aim, and contribution of research, objectives of research study and also the research design and methodology adopted. Chapter two provides the theoretical framework of the relationships proposed in this research. The hypotheses between variables to test the statements framed. Chapter three provides details about the research instruments developed, the constructs developed based on the literature review followed by the reliability and validity test results. Chapter four presents the outcome of the analysis made in graphical representation and tabulation of data and interpretation. It also includes the statistical tools used for testing of hypotheses. Finally chapter five presents the major findings, recommendations made and conclusions.
Chapter 1
Introduction

Chapter 2
Review of Literature and Research Methodology

Chapter 3
Theoretical Framework and Hypotheses Development

Chapter 4
Instrument Development, Reliability and Validation Tests

Chapter 5
Analysis of Lean Manufacturing Practices

Chapter 6
Recommendations and Conclusions

Fig: 2.2 Layout of the thesis