

## **Impact of Lean Manufacturing on Operational Performance: A Study of Sri Lankan Manufacturing Companies**

N.C Samarasiri<sup>1</sup>B.D Mathararachchi<sup>2</sup> and University of Moratuwa<sup>1</sup> University of Moratuwa<sup>2</sup>  
nawodic@uom.lk, darshikab@uom.lk

### **ABSTRACT**

The purpose of this paper is to examine the extent to which lean management practices are adopted by manufacturing organizations in Sri Lanka and their impact on firms' operational performance. Using a survey questionnaire, data were collected against 13 lean practices from 45 middle and senior managers belonging to 45 manufacturing firms in Sri Lanka. Using factor analysis these lean practices were then clustered into three higher level constructs namely just in time (JIT), waste minimization and flow management. The responding firms were categorized into small and medium companies (SMCs) and large companies (LCs) based on size. The multiple regression models were employed to investigate the effects of three lean constructs on operational performance for both small and medium and large company's categories. The operational performance is measured by four parameters such as quick delivery compared to competitors, unit cost of products relative to competitors, overall productivity and customer satisfaction.

According to results which found from the analytical tools indicates the positive relationship between lean practices and operational performance. JIT and waste management constructs have a less significant impact on operational performance in both LCs and SMCs whereas flow management construct has a significant impact on LCs compared with SMCs. The paper provides insights into the adoption of lean practices in an Asian context and using survey data, and provides further evidence regarding the relationship between lean practices and operational performances.

**Keywords:** Lean production, Factor analysis, Manufacturing industries, Sri Lanka, Operations and production management.

### **Introduction and Research Problem/Issue**

To face the unprecedented global competition, companies must design and offer better products and services and improve their manufacturing performance. Therefore, many companies have been using lean manufacturing concept to improve the operational performance. Lean concept has undergone and is still undergoing the process of continuous and never-ending evolution. Much of the research had examined the impact of lean manufacturing on performance in the developed countries, such as Japan, the USA, and the UK etc. Amoako et al, (2001) suggested that no much attention had been paid to investigate the Lean manufacturing performance in the developing countries. So, the researchers have believed that in order to get a clear image regarding the impact of Lean Manufacturing on performance, investigations in the context of developing countries are substantially essential (Nawani et al, 2012).

Few studies have been done by many researchers in Sri Lanka to explore the impact of Lean Manufacturing Practices on performance based on the industry. For examples, Senaratne and Wijesiri (2008) studied about the sustainability and acceptability of lean practices among the construction industry in Sri Lanka. As well as Gamage et al, (2012) had been done the case study of an apparel manufacture to explore the impact of Lean practices on both performance and organization culture.

Reviewing the researches and the case studies done to explore the impact of Lean manufacturing in Sri Lankan overall manufacturing sector, there is no much investigation had been focused on the Lean Manufacturing Performance. So, the purpose of this research is to examine the extent to which the lean management practices are adopted by manufacturing organizations in Sri Lanka and their impact on firm's operational performance.

### Research Methodology

As there are many Sri Lankan manufacturing industries 70 manufacturing firms were randomly selected to distribute the questionnaire to analyze the lean implementation of the manufacturing companies. Although the expected sample size was 70 manufacturing companies, finally it is limited to 45 due to the lack of responses from the selected companies.

To collect the data, a short and simple questionnaire was designed and sent by email to the person in charge of manufacturing process or lean implementation in different industries which were randomly chosen. From the total sent, 64 percent were received back adequately answered and were analyze the results considered in this this research. **Table I shows the type of data gathered through the questionnaire. Chart I : Lean practices under the three construct**



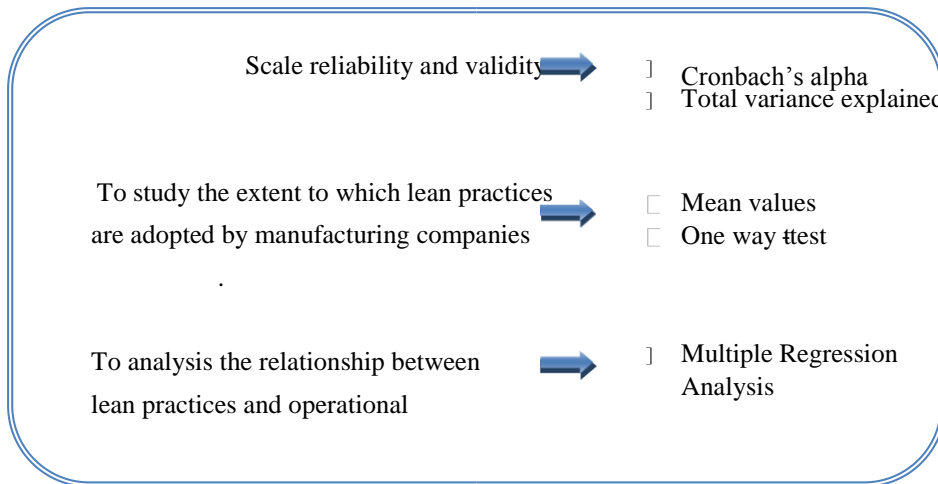
JIT

- Reduction of Inventory
- Use of new process technology
- Preventive maintenance
- Cycle Time reduction
- Use of quick change over techniques
- Reduction of setup time



Waste Minimization

- Eliminating Waste
- Use of error proofing techniques
- Removal of bottle necks techniques
- Pull based production



### Lean Practices



#### Flow Management

- Reducing production lot size
- Focus on signal supplier
- Continuous Flow

### Chart II: Method of data analysis

➤To analysis the ➤ in Sri Lanka ➤ performance.

## Results and Findings

### Key characteristics of respondents

A majority of the respondents represents large companies (55.6 percent). In terms of ownership, 63.9 percent of the responding companies indicated that they were Sri Lankan owned, foreign companies were 8.9 percent and the remainder (22.2 percent) indicating that they were a joint venture company. Among the respondents, a majority of companies (53.3 percent) has supplied products for both local and overseas markets, 28.9 percent of companies have provided only for overseas market and the remainder for a local market (17.8 percent). Finally, all companies have been certified to at least one recognized standards such as SLS, ISO 9001:2000, ISO 14000 and most of companies have been certified to more than one standard.

### The extent to which lean strategies are adopted by the manufacturing companies

If the mean value of each lean practices is above 3.0, it is considered a connection between the answers, if the mean is 5.0, it is indicated that the connection is strong to a great extent. According to the results some of lean practices scored a mean between 3.0 and 5.0. As well as t- value of all 13 lean practices is less than significant level  $p=0.05$ . Thus, both mean and t-values indicates, that the manufacturing companies in Sri Lanka employ the lean strategies at greater extent for their operation to create the productive output to their customers.

The relationship between lean strategy and performances

### **Small and Medium Companies**

All 13 lean practices combined could only account for 99.8 of total variation in operational performance. This implies that, the remaining percentage of each operation performance 0.2 percent is as a result of other factors not covered by this study. According to the adjusted R square, 96.8 percent is the variation that explained by lean practices that really affect the operational performance. Thus, there is a positive relationship between lean practices and operational performance.

According to the ANOVA table results which show the relationship between lean practices and operational performance is significant because ANOVA table indicates that  $0.000 < 0.05$ . Also the F-test value 48.592 is high, therefore this model is fitted at the proportion of 48.592. When studying the impact of lean practices as the three construct namely, JIT, flow management and waste management on operational performance, p-values of three constructs are greater than the significant level  $p=0.05$ . Thus, it implies that 13 lean practices as the three construct is a poor predictor of the relationship of its impact on performances.

### **Large Companies**

All 13 lean practices all combined could only account for 96.4 percent of total variation in operational performance. This implies that the remaining percentage of each operation performance of 3.6 percent is as a result of other factors not covered by this study. According to the adjusted R square, 99.2 percent is the variation that explained by lean practices that really affect the operational performance. Thus, there is a positive relationship between lean practices and operational performance.

The p-value of two variables are greater than the significant level  $p=0.05$ . Flow management construct in which three lean practices are included with a significance level of 0.000 proves that the model is a good predictor of the relationship between established flow management construct and operational performance. Therefore, the overall model which is used to measure the relationship between three constructs and operational performance of large companies is not significant. So, it implies that 13 lean practices as the three construct is a poor predictor of the relationship of its impact on performances.

### **Conclusions, Implications and Significance**

According to results which found from the analytical tools, that indicates the positive relationship between lean practices and operational performance. JIT and waste management constructs have a less significant impact on operational performance in both Large Scale Companies(LC) and Small & Medium Scale Companies(SMC) where as flow management construct has a significant impact in LCs compared with SMCs. Proper implementation of lean and the training among employees are indicted as recommendations. Further, the findings of the study show that there is a great need of improving their performance through proper implementation lean manufacturing practices for importantly small and medium companies compared with large companies to compete and sustain in the global market. This research analysis was only limited to operational management and the study identified the factors which may impact on performance than lean practices. Thus; further research is required to focus on those factors which are beyond the operational factors.

## References (Selected)

- Azharul Karim and Kazi Arif-Uz-Zaman, (2013), "A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations", *Business Process Management Journal*, Vol. 19 Iss 1 pp. 169 – 196.
- Arbjorn, J.S. and Freytag, P.V. (2013), "Evidence of lean: a review of international peerreviewed journal articles", *European Business Review*, Vol. 25 No. 2, pp. 174205.
- Boppana V. Chowdary Damian George, (2011), "Improvement of manufacturing operations at a pharmaceutical company", *Journal of Manufacturing Technology Management*, Vol. 23 Iss 1 pp. 56 – 75.
- Dávid Losonci Krisztina Demeter, (2013), "Lean production and business performance:international empirical results", *Competitiveness Review: An International Business Journal*, Vol. 23 Iss 3 pp. 218 – 233.
- Dr. C.S. Chethan Kumar and Dr .N.V.R. Naidu, (2012), A Survey on Awareness of Lean Manufacturing Concepts in Indian Garment Manufacturing Industries” , International Conference on Challenges and Opportunities in Mechanical Engineering, Industrial Engineering and Management Studies.
- Farzad Behrouzi and Kuan Yew Wong (2011) , “Lean performance evaluation of manufacturing system : A dynamic innovative approach”, *Procedia computer scienc*
- Ferdousi, F. and Ahmed, A., (2009), “An investigation of manufacturing performance improvement through lean production: A study on Bangladeshi garment firms,” *International Journal of Business and Management*, 106-114
- Gamage J.R., Vilasini P.P.G.N., Perera H.S.C. and Wijenatha L., Impact of Lean Manufacturing on Performance and Organisational Culture: A Case Study of an Apparel Manufacturer in Sri Lanka.
- Gulshan Chauhan and T.P. Singh, (2012), "Measuring parameters of lean manufacturing realization", *Measuring Business Excellence*, Vol. 16 Iss 3 pp. 57 – 71.