

Lean In Supply Chain Management

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ABSTRACT: Lean in supply chain management (LSCM) is one of the emergent fields of research. The present study objective is to perform review on existing LSCM in the industries and to propose major factors that affect LSCM. Although SCM practices are becoming integral part of the manufacturing sector, their impacts on product quality and business performance remain largely unknown. In order to enhance the managerial understanding of lean production and performance, the study was carried out which collected around 20 LSCM frameworks in various brick manufacturing industry with the help of extensive questionnaire survey. From this survey, the major factors that influences the adaption of Lean principles in SCM was found out. The interrelationships between these factors were examined by using Pearson Correlation Coefficient. Also suggestive solutions were given for the implementation of Lean principles in Supply Chain Management.

KEYWORDS: Lean principles; Lean Supply Chain Management; Pearson Correlation Coefficient.

I. INTRODUCTION

Over the past two decades, the theory and practice of supply chain management (SCM) has received considerable attention from academics and practitioners alike. The pursuit for quality product and waste reduction are driven by the need to survive and remain competitive. Indeed, lean production is an integrated activity in SCM designed to achieve high-volume flexible production using minimal inventories of raw materials. Lean production focuses on continuously improving the processes, a philosophy of eliminating all non-value adding activities and reducing waste within an organization.

Supply chain management is the integration of key business processes from end-user through original suppliers that provides products, service, and information that add value for customers and other stakeholders. SCM involves integration, co-ordination and collaboration across organizations and throughout the supply chain of such functions as

- Distribution planning,
- Demand forecasting,
- Purchasing,
- Requirement planning,
- Production planning,
- Warehousing,
- Material handling,
- Inventory,
- Packaging,
- Order processing and
- Transportation, etc.

All these functions are considered as building blocks of SCM in today's business environment.

SCM seeks to enhance performance by closely integrating the internal functions within a company and effectively linking them with the external operations of suppliers and chain members.

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SCM views the entire supply chain (Fig 1), rather than just the next part or level, and aims to increase transparency and alignment of the supply chain's co-ordination and configuration, regardless of functional or corporate boundaries. The basic idea of SCM is to recognize the interdependency in the supply chain, and thereby improve its configuration and control based on such factors as integration of business processes.

There are also other illuminating typologies of SCM. First, there are development issues of SCM, including order information transparency, reduction in variability, synchronizing of material flows, management of critical resources and configuration of the supply chain.

Second, there are strategies for SCM including establishment of stable partnerships, modular outsourcing of components, design for suitability for manufacture, flexible manufacturing technologies, evolution of the supply chain with the product life cycle, and information acquisition and sharing.

Third, there are levels of SCM that can be distinguished, including initial partnership (e.g. building good relations with suppliers and distributors), logistics management (e.g. implementing and controlling the flow involving all actors in the chain), and "genuine SCM" (e.g. continuous improvement of all aspects of the entire chain)

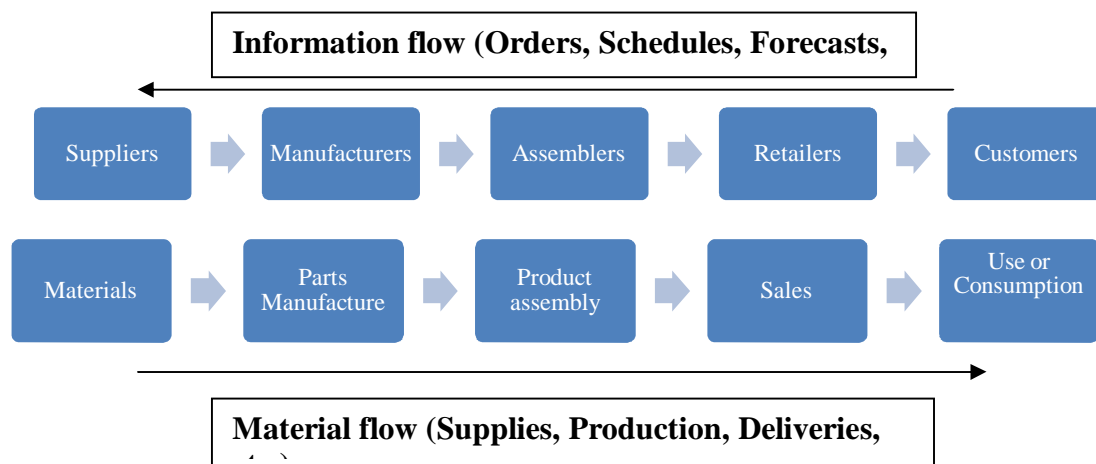


Fig 1 Generic Configuration of a Supply Chain in Manufacturing.

II. RELATED WORK

Literature review summarizes, interprets, and critically evaluates existing literature in order to establish current knowledge of a subject. The review of literature on the Lean in supply chain management is briefly presented

G.Anand et al., (2008) ^[1] found the adaptation of lean principles from manufacturing to the SCM activities is not a simple process. The reasons that they found are: manufacturing processes focused on flow of material than information, manufacturing waste is possible to identify and quantify that is not possible in SCM activities to measure information flow waste, manufacturing processes can be controlled through top management and employees of the organization, but SCM requires attention from entire supply chain from suppliers to customers. However, the main focus of lean principles is to identify waste in the process. Waste is an activity, which does not create any value to the customer or product. In SCM, wastes are created by improper information flow, material flow and funds in the system.

Vitasek et al., (2005) ^[13] defined LSC as 'a set of organizations directly linked by upstream and downstream flows of products, services, information and funds that collaboratively work to reduce cost and waste by efficiently pulling what is needed to meet the needs of individual customers'.

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Naga Vamshi Krishna Jasti et al., (2015) ^[9] discussed the complete methodology and classification scheme used to classify existing LSC frameworks and gives a critical review of the existing LSC frameworks. This paper proposes a LSC conceptual framework and also illustrates its merits when compared with existing LSC framework and describes the importance of each pillar in the LSC framework proposed.

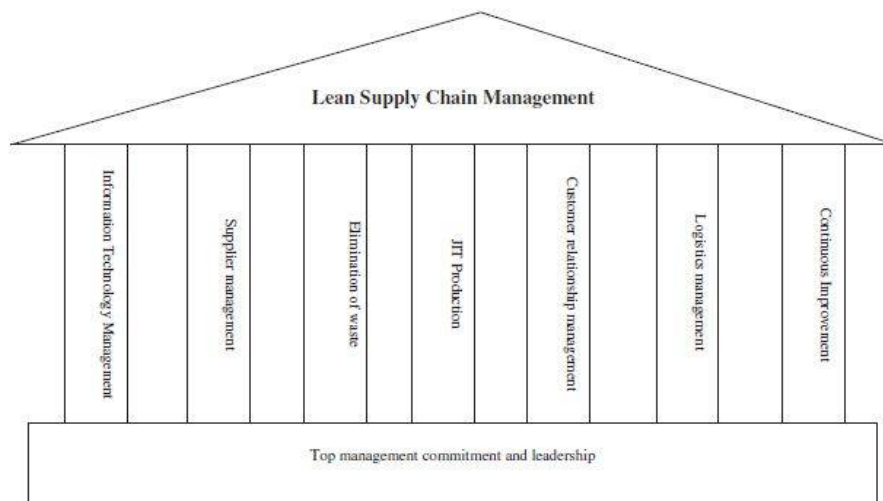


Fig 2 The conceptual LSCM framework

Baum, D (2004) ^[2] found that, information and inventory had close relationship in the system and were dependent on each other. One of the objectives of lean principles is to restrict inventory in the system. It is clearly reflected that the need of avoiding information waste in the SCM is to bring down inventory levels of the organization. It is a well-known fact that the information is considered to a major cause of wastes in the SCM system.

Hong-xian Yuan et al., (2012) ^[7] optimized a lean thinking-based model of integrated supply chain in real estate that effectively integrates both inner and outer resources of the real estate enterprises. The internal and external nodes in the supply chain can be corresponded through an information service platform, integrating the logistics platform and the financial flow platform effectively which realizes the integration of information and resources in the supply chain. It helps real estate enterprises to acquire a new management concept so as to enhance their competitive advantages through the organizational integration, the process integration, and the informational integration.

- ❖ The major factors that influences implementing Lean in Supply Chain Management are
 - Supplier Management
 - Elimination of waste
 - Customer Relationship Management
 - Logistics Management
 - Continuous Improvement

- ❖ In SCM, wastes are created by improper information flow, material flow and funds in the system.

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III. METHODOLOGY

Lean in supply chain management is not exclusively for those companies who manufacture products, but by construction industries who want to streamline their processes by eliminating waste and non-value added activities. Companies have a number of areas in their supply chain where waste can be identified as time, costs, or inventory. To create a leaner supply chain, companies must examine each area of the supply chain.

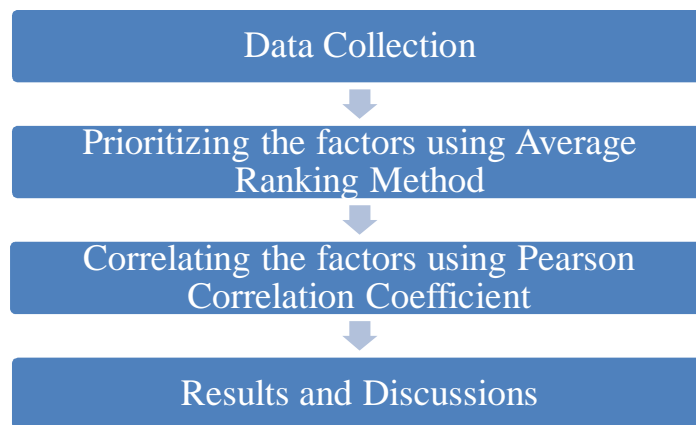


Fig 3 Methodology of the project

In order to perform the intended applications, it is important to collect relevant and reliable data from the selected brick manufacturing industries (viz., Google forms). This Questionnaire survey included the questions related to Supplier Management, Customer Relationship Management, Elimination of Wastage, and Continuous Improvement in their industries.

This Questionnaire survey was made in Google forms.

The collected data was analyzed using Average ranking method for prioritizing the factors that were collected.

Average ranking method calculates the average ranking for each answer choice so that we can determine which answer choice was most preferred overall. The answer choice with the largest average ranking is the most preferred choice.

The average ranking is calculated as follows,

$$\frac{x_1 w_1 + x_2 w_2 + x_3 w_3 \dots x_n w_n}{Total}$$

Where,

w = Weight of ranked position

x = Response count for answer choice

Based on the analysis, the identified major factors are

- Long term supplier relationship
- Single source and reliable suppliers or few suppliers
- Transport and distribution by suppliers
- Feedback from customers
- Standard process and product

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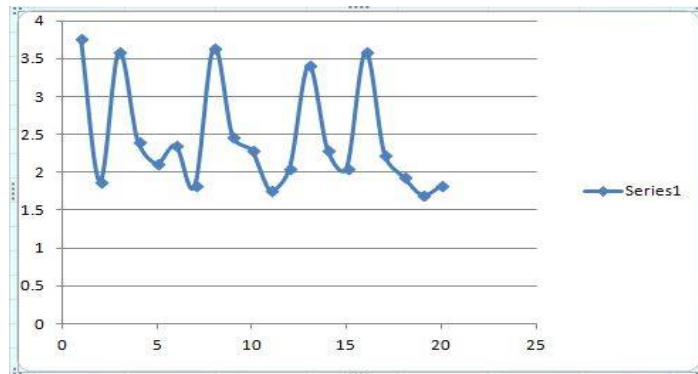
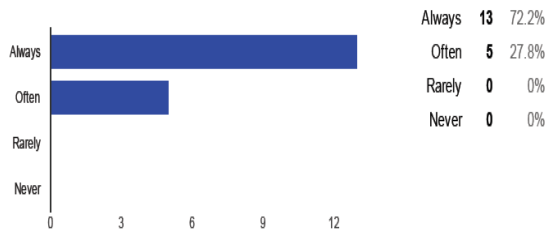
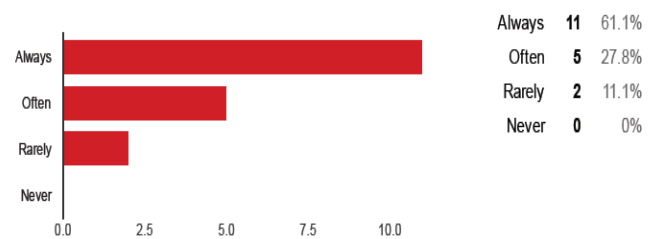


Fig 4 Prioritized factors

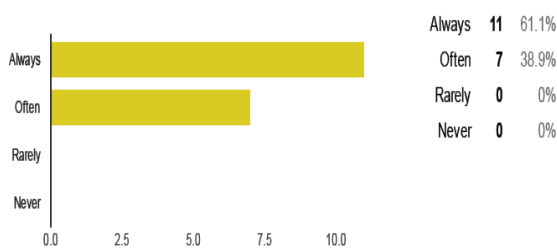
1. Long term supplier relationship



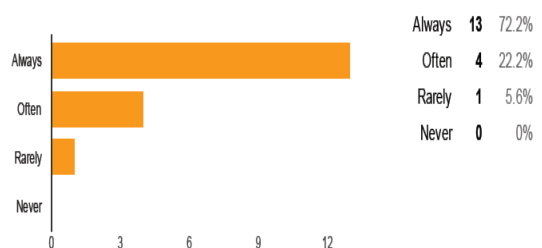
3. Single source and reliable suppliers or few suppliers



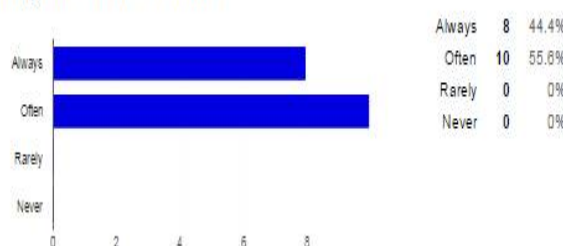
2. Using standard product and process



8. Availability of transport and distributions by suppliers



3. Getting feedback from customer



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In order to identify the interrelationships between the prioritized factors, Pearson Correlation Coefficient was found out for these factors.

Pearson's correlation coefficient(r) is the covariance of the two variables divided by the product of their standard deviations. It lies between +1 and -1 inclusive, where 1 is total positive linear correlation, 0 is no linear correlation, and -1 is total negative linear correlation.

If $r = \pm 0.5$, then the interrelationship is large, ± 0.3 it is medium, and ± 0.1 it is small.

There is large interrelationship between Single Source Suppliers and availability of transport and distribution and also between Single Source Suppliers and Standard Product and Process which is shown in table 1.

Table 1 Factors having Large effect

| <i>Single source and reliable suppliers or few suppliers</i> | | <i>Availability of transport and distributions by suppliers</i> | |
|--|-------------|---|---|
| Single source and reliable suppliers | 1 | | |
| Availability of transport and distributions by suppliers | 0.421649691 | | 1 |

| <i>Single source and reliable suppliers or few suppliers</i> | | <i>Using standard product and process</i> | |
|--|-------------|---|---|
| Single source and reliable suppliers | 1 | | |
| Using standard product and process | 0.421926508 | | 1 |

There is medium interrelationship between Long term Supplier Relationship and Single Source Suppliers and also between Availability of Transport and getting Feedback from Customers which is shown in table 2.

Table 2 Factors having Medium effect

| <i>Long term supplier relationship</i> | | <i>Single source and reliable suppliers or few suppliers</i> | |
|--|--------------|--|---|
| Long term supplier relationship | 1 | | |
| Single source and reliable suppliers | -0.380749805 | | 1 |

| <i>Availability of transport and distributions by suppliers</i> | | <i>Getting feedback from customer</i> | |
|---|-------------|---------------------------------------|---|
| Availability of transport and distributions by suppliers | 1 | | |
| Getting feedback from customer | 0.298807152 | | 1 |

Other combinations of factors are having least effect only which is shown in table 3.

Table 3 Factors having least effect

| <i>Getting feedback from customer</i> | | <i>Using standard product and process</i> | |
|---------------------------------------|--------------|---|---|
| Getting feedback from customer | 1 | | |
| Using standard product and process | -0.028571429 | | 1 |

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| | | |
|------------------|--------------------------------|---|
| | Getting feedback from customer | Single source and reliable suppliers or few suppliers |
| Getting feedback | 1 | |
| Single source | -0.023440362 | 1 |

IV. CASE STUDY

A case study is an empirical inquiry that investigates a phenomenon within its real-life context.

We have visited Madurai bricks on September 29, 2016 which was located near Avaniyapuram, Madurai. We have been exposed to their method of production, equipments and materials used, their suppliers and customers. Various factors and sub factors which affect the implementation of Lean principles in Supply Chain Management are listed in table 4.

Table 4 The Pillars of LSCM and respective elements

| S.No. | Pillars | Sub-elements |
|-------|----------------------------------|---|
| 1 | Supplier Management | <ul style="list-style-type: none"> • Strategic supplier development • Supplier evaluation and development • Long-term supplier relationship • Supplier involvement in design • Supplier feedback • Supplier proximity • Single source and reliable suppliers or few suppliers • Cost-based negotiation with suppliers • Joint decisions towards cost savings |
| 2 | Elimination of waste | <ul style="list-style-type: none"> • Design for manufacturing • Standard products and processes • Focused factory production • Visual control • Flexible manufacturing cells or U-shape manufacturing cells |
| 3 | Customer Relationship Management | <ul style="list-style-type: none"> • Post sales service to customer • Customer involvement in design • Continuous evaluation of customers feedback • Customer enrichment • Delivery performance improvement • Failure mode and effect analysis |

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| | | |
|---|---------------------------|---|
| 4 | Logistics Management | <ul style="list-style-type: none"> • Effective logistics network design • Consultants as logistics managers • Advance material requirement planning and scheduling structure • Use of third party logistics for transportation system • Master the demand forecasting process • Elimination of buffer stocks |
| 5 | Top Management Commitment | <ul style="list-style-type: none"> • Create vision and objective to lean supply chain • Employee training and education in LSCM • Cross-enterprise collaborative relationships and trust • Joint planning of processes and products with suppliers • Resources allocation • Employee empowerment • Stable and long-term employment • Leadership development |

V. RESULTS AND DISCUSSIONS

From the surveys conducted on various brick manufacturing industries, various factors which affect the implementation of Lean in SCM was found out. By using an average ranking method, these identified factors are ranked and prioritized.

The major factors that were identified are

- Long term supplier relationship
- Single source and reliable suppliers or few suppliers
- Transport and distribution by suppliers
- Feedback from customers
- Standard process and product

Later the interrelationships between these identified factors are found out using Pearson Correlation Coefficient.

There is large interrelationship between Single Source Suppliers and availability of transport and distribution and also between Single Source Suppliers and Standard Product and Process. So these three factors are the most predominant factors that affect the implementation of Lean principles in Supply Chain Management.

There is a medium interrelationship exists between Long term Supplier Relationship and Single Source Suppliers and also between Availability of Transport and getting Feedback from Customers in implementing Lean in SCM.

By adapting Single Source Suppliers, availability of transport and distribution and by following Standard Product and Process, we can maintain a proper and efficient supply chain in the industry.

The adaptation of lean principles to the SCM activities is not a simple process. The reasons that were found are: it is impossible to identify and quantify waste in SCM activities to measure information flow waste; also SCM requires attention from entire supply chain from suppliers to customers. However, if it is properly adapted, the cost and time can be reduced without affecting the productivity of the organization.

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