Review of lean manufacturing practices – critical success factors and performance measures for SMEs

Suketu Y. Jani*

Mechanical Engineering Department,
C.U. Shah University,
Wadhwan, Gujarat, India
Email: suketu.jani@gmail.com
*Corresponding author

T.N. Desai

Department of Mechanical Engineering,
SVNIT, Surat, Gujarat, India
Email: tushardesaisvnit@gmail.com

Abstract: The intense competition in the current marketplace has forced industrial firms to re-examine their methods of carrying out manufacturing activities. Indian manufacturing organisations are showing keen interest in the adoption of advanced manufacturing technologies and associated management and quality philosophies. In order to compete in global markets, they necessarily need to acquire world-class performance. The goals of manufacturing excellence efforts include maintaining market share, improving profitability and the firm’s ability to compete in a global market place. The paper describes the concept, approaches and identification of critical success factors, performance measures for lean manufacturing practices. As a lean manufacturing system is a way to achieve manufacturing excellence. So the factors affecting successful implementation of lean manufacturing is very important for practitioners like small and medium scale manufacturing industries as well factors required to monitor the lean practices in terms of performance measures. The paper will brief about all the contemporary factors regarding implementation and performance measurement.

Keywords: lean practices; critical success factors; performance measures; small and medium scale enterprises.


Biographical notes: Suketu Y. Jani is a PhD Scholar at C.U. Shah University in Mechanical Engineering Department and also serving as the Head of Automobile Engineering Department at Indus University. He has more than seven years of teaching experience and two years of industry experience as a consultant.

T.N. Desai is serving as an Associate Professor in Mechanical Engineering Department at SVNIT, Surat. He has a vast teaching experience at UG and PG level. He is regularly conducting training programs and conferences at national level and international level.
1 Introduction

To produce variety of products with minimum lead time, reduced inventory and world class quality is one of the major challenges. The industrial organisations must take steps to improve their competitiveness to cater to the fast changing market. The Indian organisations are paying attention to quality but they are not sure about the faster throughout and delivery with variety. The industrial firm’s main focus is always on better utilisation of resources, we should find out areas where the resources are not wasted and converted fully to the designed output. The removal of waste or unnecessary work or NVA activities lead to improvised productivity and quality and ultimately to customer satisfaction and profit. Some widely employed philosophies for technological and organisational changes are WCM, LMS, TQM, JIT, Agile manufacturing, BPR, etc.

2 Manufacturing excellence

Indian organisations are now showing keen interest in the adoption of advanced manufacturing technologies and associated management and quality philosophies and in the principles of manufacturing excellence. Manufacturing excellence (or elegance) is proposed as a keyword expressing the enhancement of the conditions of goods production for pursuing human happiness, and eliminating the ‘hollowing’ of production, unattractiveness of employment in manufacturing and environmental impact.

3 Approaches to manufacturing excellence

The following methods are effective to moving towards manufacturing excellence:

1. high added-value production
2. manufacturing for customer satisfaction
3. automated production/CIM systems
4. flexible/human-centred production
5. green production
6. socially appropriate production.

4 Lean manufacturing

Lean manufacturing is a philosophy, a production strategy and a set of techniques to meet customer requirements within a minimum of every resource. Lean is about doing more with less time, inventory, space, people, efforts and capital. It is an integrated business approach adopted to eliminate NVA activities to identify and eliminate wastes permanently from the customer delivery cycle in the operation and to create a work culture in which people at various levels of an organisation continuously improve their productivity every day in every way.
Table 1  Taiichi Ohno’s seven wastes

<table>
<thead>
<tr>
<th></th>
<th>Waste</th>
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<tbody>
<tr>
<td>1</td>
<td>Waste of overproduction.</td>
<td>5</td>
<td>Waste of inventory.</td>
</tr>
<tr>
<td>2</td>
<td>Waste of time.</td>
<td>6</td>
<td>Waste of motion.</td>
</tr>
<tr>
<td>3</td>
<td>Waste of transportation.</td>
<td>7</td>
<td>Waste of making defective products.</td>
</tr>
<tr>
<td>4</td>
<td>Waste of processing itself.</td>
<td></td>
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</table>

5  Benefits of lean manufacturing

- reduction in manufacturing cycle time
- reduction in waste
- reduction in cost of production
- reduction in inventories and labour
- increase in quality
- increase in profits
- increase in customer service levels
- increase in capacity in current facilities
- increase in customer service levels
- increase in capacity in current facilities
- increase in quality, profits
- more value to the customer
- simple and multitask machinery which aids variety products manufacturing
- integrates people and techniques to improve the work place
- strengthens company’s competitive position.

6  Key features of lean production

1  reduced set up cost and times
2  small-lot production
3  pull production or JIT
4  quality at source
5  continuous equipment maintenance
6  flexible (multi-skilled) workforce
7  employee involvement and empowerment
8  supplier involvement
7 MSME status and current scenario

First the definition of small and medium scale industry as applicable in India is presented, under the micro, small and medium enterprises development (MSMED) Act 2006, the earlier, rather limited, concept of Industries has been widened to that of enterprises. Enterprises have been classified broadly into two categories, namely enterprises engaged in the manufacture/production of goods pertaining to any industry; and enterprises engaged in providing/rendering of services.

Enterprises have been defined in terms of investment in plant and machinery/equipment (excluding land and building) as given in Table 2.

<table>
<thead>
<tr>
<th>Type of enterprise</th>
<th>Investment in plant and machinery/equipment (excluding land and building)</th>
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<tbody>
<tr>
<td></td>
<td>Manufacturing enterprises</td>
</tr>
<tr>
<td>Micro</td>
<td>Upto Rs. 25 lakh</td>
</tr>
<tr>
<td>Small</td>
<td>More than Rs. 25 lakh and up to Rs. 5 cr</td>
</tr>
<tr>
<td>Medium</td>
<td>More than Rs. 5 cr and up to Rs. 10 cr</td>
</tr>
</tbody>
</table>

Source: Website of Ministry of MSME

The current literature suggests that the SMEs may differ from the larger companies by a number of the key characteristics. Some of them are putting the greater strains on the SMEs inducing that the business development may be more challenging in this context (Bala Subrahmanya, 2007; Ghobadian and Gallear, 1996):

- The resource limitations associated with the SMEs highlights the importance of the Productivity.
- The lack of money may cause the liquidity risk.
- The reliance on a small number of the customers means that the SMEs must ensure the high level of the customer satisfaction and the flexibility to respond quickly to the changes in the market.
- The flatter structure of the SMEs means that the employees have several job roles and more responsibility. The multi-skilled employees are necessity to the enterprises.

Small and medium scale engineering enterprises (hereafter referred as SMEs) cover a wide spectrum of industries and play an important role in both developed and developing economies. India is no exception and SMEs play a vital role in planned development of Indian economy. SMEs have been consistently outperforming large industry on crucial parameters such as growth in production and growth in employment. The SME sector accounts major percentage of the industrial production, total export and the employment in the industrial sector in the country. Considering to Confederation of Indian Industries
(CII) MSME Outlook Survey (December 2009) on exports, respondents registered an increase in volume of their exports over the past six months and in next six months. Surveyed respondents expect an increase in volume of their exports by 10 to 20%. It reveals that, like many developing countries, the future of Indian economy depends to a great extent on the success of many SMEs. The export from SME indicate that, Indian SMSs are now more and more taking active part in the global business network and are becoming a part of many interlinked supply chains, which demands for implementation of ISO/QMS. Even though the SMEs are contributing in National growth, for last many years SME sector is facing two major problems viz.,

a closer/failure rate is very high as compared to Large Scale Industries (LSI) and other businesses

b not performing well units i.e., many SMEs are performing at no profit/low profit levels leading to critical conditions prone to closer/failure of the unit in competitive environment.

Some earlier scholars, e.g., Ghobadian and Gallear (1996), Rahman (2002), Gotzamani et al. (2006), Arauz and Suzuki (2004), Demirbag et al. (2006), Bayati and Taghavi (2007), Gadenne and Sharma (2009), etc. have reported some common problems related to different aspects of ISO/QMS implementation faced by SMEs. These are:

a acquiring ISO 9000 certification for SMEs takes too much money and time

b lack of resources in the form of time and personnel

c lack of financial capacity within SMEs and, therefore, they find it difficult to appoint a facilitator or coordinator (that may) lead to poor QMS/ISO implementation

d SMEs also have limited resources to provide internal training

e the uniqueness and complexity of SMEs manufacturing operations often hinder the implementation process

f a deeper understanding of the concept of variation, identification of causes of variation, handling of the causes are important factors and requires competent manpower and measurement systems which are absent in SME

g SMEs principally aim to achieve ISO certification and it will take a long time for them to consider other quality systems, e.g., total quality management (TQM).

8 Critical success factors

Rockart (1979) has defined the CSFs as “the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization”. Critical success factors are crucial to the success of a program, and if the objectives associated with these factors are not achieved, the application program will also lead to failure. The CSFs are the actions and processes that can be controlled by the
management to achieve the organisation’s goals (Brotherton and Shaw, 1996). Any improvement initiative means high expenditure, investment (Ranjan and Bhatnagar, 2008) and high risk (Umble et al., 2003) for an organisation. So it is important to identify the factors that can determine the success of the implementation and avoid the risk of failure. If these CSFs are not emphasised, not only there could be a significant difference in the success gained, but also losses in terms of effort, time and money. The critical success factors are essential parts that must be addressed by management or the manager to ensure that ‘things must go right’ for a project or activity to achieve management objectives and business growth. In the context of lean manufacturing project implementation, CSFs represent the essential ingredients without which the implementation stands little chance of success.

A number of researchers have considered the role of the CSFs in lean implementation. The authors develop a conceptual critical success factors for lean thinking based on the literature review. The success factors put together as the enablers of lean thinking and relationships between them for a successful lean implementation. It includes the practices, principles and processes needed for adoption of lean thinking within the whole organisation. Lean thinking is ‘operationalised as an integrated quality management approach’, that has an impact over the whole organisation including its stakeholders-suppliers and other business partners, customers, etc.

9 Performance measurement system

Drew et al. (2004) based on his experience, states that an organisation’s performance management system is often the very poor link in the management facility that underpins the lean operating system. A successful performance management system in a lean operation is much more than just a colourful set of reports, or the tracking of the right metrics; it goes right to the heart of management. A performance management system in a lean context calls for not only a clear system definition – the right metrics, supported by effective tracking and reporting processes, information technology tools and linkages to financial and other systems – but also the right approach to managing the dynamics of performance hour by hour, shift by shift, day by day, month by month. The people who operate the lean processes must be able to see and understand the critical measures of performance so that they can take the right steps to make high performance an everyday reality.

As per the view by Drew et al. (2004) that every organisation embarking on the lean journey will need to consider whether its formal management processes, organisation structure and capability-building infrastructure reinforce the new lean operating system. If the management infrastructure is not aligned properly, the operation is unlikely to achieve its performance objectives/performance excellence. Three key aspects of organisational structure determine whether it is aligned with the operating system: the size of the cross functional/front-line team, the role of the team leader/managers, and the spans of control and levels of hierarchy in the organisation.

Lean matrix shows that, the SMEs still have the potential to succeed in lean although the barriers are there and how it can be overcome for particular lean technique. SMEs have strengths and advantages to obtain operational and financial benefits, through lean philosophy compared to large company.
Figure 1  Lean matrix for performance measurement (see online version for colours)

![Figure 1: Lean matrix for performance measurement](image)

However, Finch (1986) had investigated the difficulties in which SMEs may face the problems compared to large company:

1. SMEs may not have negotiating/no choice or power to ensure suppliers provide frequent delivery and quality standards due to small business network
2. SMEs have limited resources/facilities i.e., manpower and financial, to make operational changes for lean practices implementation
3. SMEs’ management has lack of exposure on lean practices, lack of awareness in terms of implementations
4. SMEs have very less time for completing the order for incorporating the lean techniques over the period of time.

### Table 3  Critical success factors of lean manufacturing

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<th>Critical success factors</th>
<th>Authors</th>
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### Critical success factors of lean manufacturing (continued)

<table>
<thead>
<tr>
<th>Critical success factors</th>
<th>Authors</th>
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</table>

### 10 Performance measures of lean practices

KPI concept for a Lean implementation is presented paying special attention to the critical role of the leadership. There has not been found any literature integrating the leadership performance dimension into a performance measurement system. Hence further need of research in this area is necessary according to its relevance (Achanga et al., 2005; Collins, 2001). The need of an early integration of a KPI concept supporting a Lean implementation process mentioned by Karlsson and Åhlström (1996) could be confirmed within the case study. KPIs covering the whole value stream support the paradigm change away from individual process thinking and can even provide opportunities for improvement.
Table 4  Performance measures of lean manufacturing

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<thead>
<tr>
<th>Performance measures</th>
<th>Authors</th>
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11 Conclusions

This paper has described the critical success factors and performance measures for implementation of lean practices in small and medium scale manufacturing industries in India, particularly in Gujarat. The major obstacle for lean implementation pointed out by our result is lack of awareness. Educating people on this concept as they are not much familiar with this lean in Gujarat, would results into easy implementation of lean and this
can be done by SMEs. Management commitment and employee involvement towards the concept are very important.

References


