

IMPLEMENTATION OF LEAN MANUFACTURING IN SMALL AND MEDIUM ENTERPRISES

Vikram Singh¹, Pankaj Jain²

¹Mechanical Engineering Aryabhata College of Engineering & Research center Ajmer (Raj.), India

²Mechanical Engineering Aryabhata College of Engineering & Research center Ajmer (Raj.), India

ABSTRACT

The purpose of this keynote is to explore the difficulties experienced when implementing Lean Manufacturing in small and medium sized enterprises (SME). In this work, we design a dual evaluation focusing first on the key characteristics of SMEs then on the management principles of Lean Manufacturing. Based on an analysis of the scientific literature, we observe a number of conflicts between the characteristics point out for SMEs and Lean Manufacturing. The absence of functional organization, lack of methodology and deficiency of formal procedures are often the cause of difficulties experienced by SMEs during the implementation of Lean manufacturing. The examination of the literature show that the notions of leadership, expertise and decision-making are crucial when implementing Lean Manufacturing. However, in the framework of SMEs, these elements tends to be concentrated under the responsibility of the head of the enterprise, leading to several strengths and weaknesses for such implementation.

KEYWORDS- SME, Lean Manufacturing, Implementation, Change Management

1. INTRODUCTION

The European Union defines Small and Medium Sized Enterprise (SME) as an enterprises having a turnover lower than €50 M and fewer than 250 employees. In Europe, SMEs represent 99.8% of enterprises & 67.1% of jobs in the private sector, a figure that rises to more than 80% for industrial companies (Commission, 2008).

In 2013, France had 135,000 SMEs, representing an annual turnover of €616,000 M and 2,700,000 jobs (PME, 2013). However, the financial performance of French SMEs has deteriorated constantly since the 2000s. The number of bankruptcies affecting enterprises with more than 10 employees rose from 3,100 a year in 2007 to 4,600 a year in 2012, i.e. an increase of 48%.

In 2012, in Gallois report, authors observed that SMEs suffered from major weaknesses: lack of equity capital, difficulty in opening up capital, fear of investments (Gallois, 2012). These weaknesses were aggravated by the profit results of industry over the ten previous years.

SMEs need to restore their competitiveness, as they represent a large section of the French and European economy.

Lean Manufacturing (LM) is an approach that has been used by large corporations for several years. The source of LM can be found in the Toyota Production System (TPS) and it is based on the principle of eliminating all forms of wasted value within the enterprise (Ohno, 1998). This model has been tried & verified in huge corporations (Drew et al., 2004; Panizzolo et al., 2012; Rose, et al., 2011), where productivity has been increased by more than 40%, overall defects reduced by 20% and lead times reduced by 50%.

Our partner is an enterprise that produces passive electronic components in France and elsewhere in the world. This enterprise is a conglomerate of SMEs acquired throughout the recent history of the parent company. At present, it is now a large enterprise from the administrative standpoint, but each entity still behaves like an independent SME. Our industrial partner experienced similar problems and the implementation of continuous improvement procedures had already been attempted. However, the results hoped for, were not forthcoming. Among other things, the enterprise observed:

- Problems with employee commitment;
- Major obstacles to change;
- Difficulties in convincing the managers about the actions to take and
- over-present managers leading to a lack of delegation in the field.

The success rate of LEAN implementation in SMEs is low since it reaches only 10% according to Backer's study (Backer, 2002). Several LEAN implementation approaches have been developed (Åhlström, 1998; Hobbs, 2011, 2004; Mostafa et al., 2013), but these methods are designed for mass production companies (Deflorin and Scherrer-Rathje, 2012). The size of the company is however an influential factor in the LEAN implementation (Shah and Ward, 2003; Yang et al., 2011). Indeed, SME have distinctive characteristics when compared to big companies, and their pass criteria are specific (Achanga et al., 2006).

In order to refine this analysis, a literature review of the LEAN implementation in SME has been conducted. This review has allowed the identification of the SMEs specific characteristics which have then been compared to the LEAN MANUFACTURING management philosophy principles in order to list the strengths and weaknesses encountered by SMEs.

2. LEAN MANUFACTURING

2.1 DEFINITION OF LEAN: - The term Lean was used for the first time in 1988, during the International Motor Vehicle Program, which aimed at understanding the differences in productivity between Japanese and Western industries. The term was then popularized by Womack & al. in their book “The Machine That Changed the World” (Womack et al., 1990). The source of Lean Manufacturing came from the Toyota Production System (Ohno, 1988), it is based on the principle of eliminating all forms of wasted value within the enterprise.

2.2 MANAGEMENT PRINCIPLES OF LM: - For many authors, LM is a long-term corporate strategy and a philosophy of corporate management (Liker, 2004; Spear and Bowen, 1999).

Toyota succeeded in integrating LM in its organization and has continued to do so for more than 40 years (Ohno, 1988). Liker proposed 14 management principles (Liker, 2007), that provide one of the most accepted characterizations of LM:

1. Decisions founded on a long-term philosophy, even to the detriment of short term financial objectives;
2. The organization of processes into single piece flows to identify problems;
3. Use of pulled systems (flow triggered only by client orders) to avoid excess production;
4. Production smoothing;
5. Create a culture of immediate quality problem solving the first time;
6. Standardize tasks as the basis of continuous improvement and empower employees;
7. Use visual inspection so that no fault remains hidden;
8. Use reliable technologies proven over a long time;
9. Train managers with perfect knowledge of the work, live the philosophy and teach it to others;
10. Train individuals and teams who apply the enterprise’s philosophy;
11. Respect the network of partners and suppliers by encouraging them and helping them to progress;
12. Interact with the field to clearly understand the situation;
13. Take decisions consensually, by taking the time necessary, examining in detail all the options and applying decisions quickly;
14. Reflect systematically and improve continuously. In the rest of this article, we consider Liker’s 14 management principles to cross them with the characteristics of SMEs.

3. SMALL & MEDIUM SIZE ENTERPRISES

3.1 LITERATURE REVIEW METHODOLOGY

In this study, the following databases have been consulted:

- Emerald Insight;
- Elsevier;
- Taylor & Francis. The articles consulted for the literature review have been selected according to the following keywords: “SME”, “Small and Medium”, “LEAN” and “Implementation”. The initial total number of 513 documents that has been obtained has then been reduced to 223 through the reading of all article abstracts. Finally, only the 77 articles dealing with “SME” and “LEAN” simultaneously have been selected.

3.2 CHARACTERISTICS OF PME

In accordance with the Tranfield’s method (Tranfield et al., 2003), the careful analysis of the articles allowed their classification according to different topics. Several authors already proposed characteristics lists for SMEs (Garengo et al., 2005), and Torres approach (Torres, 1999) has been selected, leading the following theme:

- Local management;
- Short-term strategy;
- Lack of expertise;
- Non-functional organization;
- Limited resources; and
- Lack of method and procedure.

On the 77 articles dealing with SMEs, only 23 point out (put forward) one or several characteristics of SMEs. The number of occurrences for each characteristic is presented in Table 1.

TABLE 1: List of SME characteristics in literature

CHARACTERISTICS	NUMBER OF REFERENCES
Lack of expertise	17
Limited resources	12
Local management	12
Short-term strategy	10
Lack of method and procedure	9
Non-functional organization	5

The author’s observations give a first indication on the SMEs weaknesses. The purpose of our research is to compare these characteristics with the LEAN management principles.

4. OBSERVATIONS & DIFFERENCES

4.1 COMPARISON BETWEEN THE CHARACTERISTICS OF SMEs AND THE MANAGEMENT PRINCIPLES OF LEAN MANUFACTURING

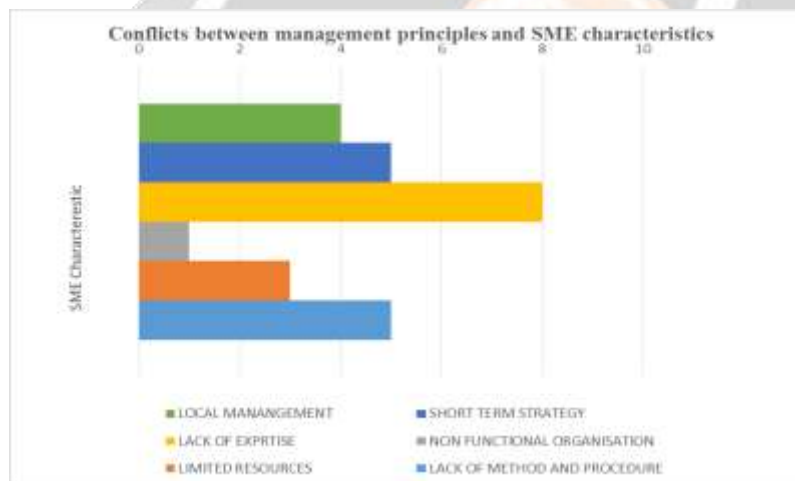
In this part, we compare the characteristics of SMEs seen previously with the principles of LM set out by Liker (Liker, 2007). In the following, we discuss the need for leadership, expertise and the involvement of decisional authority in an LM project.

We rely on a study of key works and an initial analysis of the literature on “the implementation of continuous improvement approaches in SMEs”. In view of the observations made by various authors, we have identified virtuous relations and relations of “strength” between SMEs and LM (for example, the local management existing in SMEs facilitates the LM management principle 12th of interaction with the field); as well as “relations of conflict” (for example, short-term strategy conflicts with principle 1 decision-making, which is based on a long-term philosophy). Figure 1 present the number of conflict between SME characteristics and lean principle. Table 2 presents the correlations identified by the analysis described above with the reference in identifying articles.

Regarding the lack of expertise and short term strategy, the problem stems from the mode of management applied in the SME (Greiner, 1972; Mintzberg, 1982; Torres, 1999). The lack of delegation rooted in the SME prevents employees from improving their competences and the involvement of the chief executive in operational decisions obliges them to have a short-term vision of the options.

The aim of LM is to delegate a large number of responsibilities as close as possible to the operational personnel (Liker, 2006), which conflicts with the centralized power of the chief executive. In this particular point, implementing LM requires changing the organizational culture of the SME.

We hypothesize that the failure of implementing LM in SMEs is due to the fact that the characteristics specific to SMEs are insufficiently taken into account. The informal management mode present in SMEs requires a highly credible team representative of the enterprise, the lack of expertise requires training and a longer period of apprenticeship, and the lack of leadership demands that the rare potential profiles and the power of decision centered on the chief executive make the latter a highly important and indispensable member of the team.



4.2 THE IMPORTANCE OF LEADERSHIP, EXPERTISE AND POWER OF DECISION IN ORGANIZATIONAL CHANGE

We saw that the characteristics specific to SMEs can contradict the management principles of LM. However, in the analysis of the literature, leadership, expertise and power of decision are not identified as management principles but as competences required for a lean enterprise (Achanga et al., 2006; Höök and Stehn, 2008; Taylor and Taylor, 2014).

To ensure the organizational change required for synergy with LM principles, the SME must ensure, at least in the LM project, a long-term orientation and the availability of expertise required to set up and maintain LM practices and tools (Hines et al., 2004). To do this, it has to form a team that comprises leadership, expertise, and the power of decision. Kotter defined leadership as “a number of processes that first create organizations or which adapt them through significant changes. Leadership defines how the future can be, aligns the employees with this vision and inspires them to achieve it despite the obstacles.” (J. Kotter, 1996a).

We find the importance of leadership in the works of Dombrowski (Dombrowski and Mielke, 2013) and Liker (Liker, 2006), who proposes four rules (the 4P) to describe lean principles; rule 4 is: “Develop exceptional People and Partners”. It appears clear for Liker that success in launching a lean project starts with leadership. At Toyota, the “group leader” plays a major and crucial role in the continuous improvement process. These leaders are placed at the front line in order to delegate a maximum number of responsibilities to lower levels of the chain of command. Lastly, regarding change management, Likers highly precise: “Change is impossible without leaders”. Leaders must be present and promoted at all levels: the upper, middle and lower levels of the chain of command.

Table 2. Correlation between the 14 principles of Lean Manufacturing and the characteristics of SMEs: strengths and conflicts.

<i>Management Principles of Lean Manufacturing</i>	<i>Local management</i>	<i>Short-term strategy</i>	<i>Lack of expertise</i>	<i>Non-functional organization</i>	<i>Limited resources</i>	<i>Lack of method and procedure</i>
1. Base decisions on a long-term philosophy, even to the detriment of Short term financial targets.	Conflict (Achanga et al., 2006)	(Kumar and Antony, 2008)			Conflict (Kumar and Antony, 2008)	
2. Organization of single piece flow Processes to identify problems.			Conflict (Womack and Daniel, 2003)			Conflict(Deflorin and Scherrer-Rathje, 2012)
3. Utilization of pull systems (flow triggered only by client orders) to avoid excess production.			Conflict (Womack and Daniel, 2003)			
4. Production smoothing.			Conflict (Womack and Daniel, 2003)			
5. Creation of a culture of immediate quality problem solving at first try.		Conflict (Mathur et al., 2012)	Conflict (Thomas et al., 2009)			Conflict (Kirkham et al., 2014)
6. Standardisation of tasks as the basis of continuous improvement and employee empowerment.	Conflict (Thomas et al., 2012)		Conflict (Achanga et al., 2006)			Conflict (Kirkham et al., 2014)
7. Utilisation of visual control to ensure no problem remains hidden.						
8. Utilisation of reliable technologies, tried and tested through time.				Conflict (Taylor and Taylor, 2014)		Conflict (Hudson et al., 2001)
9. Training of managers who know the work perfectly, live the philosophy and teach it to others.		Conflict (Matt and Rauch, 2013)			Conflict (Achanga et al., 2006)	
10. Training of exceptional Individuals and teams who apply the philosophy of your enterprise.	Strength (Dora et al., 2015)					
11. Respect for the network of partners and suppliers, by encouraging them and helping them to progress.			Conflict (Aitken et al., 2002)		Conflict (Bhasin, 2012)	
12. Interaction with the field to clearly understand the situation.	Strength (Matt and Rauch, 2013)					
13. Consensual decision making by taking the time necessary, by examining all the options	Conflict (Deflorin and Scherrer	Conflict (Achanga et al., 2006)	Conflict (Kirkham et al., 2014)			Conflict (Kirkham et al., 2014)

in detail, followed by rapid application of the decisions.	Rathje, 2012)					
14. Systematic reflection and continuous improvement.	Conflict (Prasanna and Vinodh,2013)	Conflict (Gnanaraj et al., 2012)	Conflict (Hudson et al., 2001)			

Leadership is not the sole important component for ensuring success when changing organizational culture. Implementing LM requires a radical change in the way things are produced. According to Womack & al. (Womack and Daniel, 2003) genuine “technical virtuosity” is essential for any lean approach. We find the importance of expertise in the research of Kotter (J. Kotter, 1996b); expertise ensures that technical decisions are correlated with the activity and constraints of the enterprise.

The lack of expertise that is observed in SMEs is the main element in conflict with the Lean Manufacturing management principles. This lack of expertise affects several fields like computer science and information flow (Iris and Cebeci, 2014), problem solving (Thomas et al., 2009), or even Lean tools (Kumar et al., 2009). This demands a substantial effort on employees training (Simons and Taylor, 2007) on the Lean philosophy and on the different Lean implementation methods (Powell et al., 2013).

The last important factor is the power of decision, which must guarantee a strong impact on time assignment, on employee motivation and on the validation of the investments required (Bakås, 2011). Kotter (J. Kotter, 1996b) emphasized the importance of the power of decision in change management. Indeed, it permits diverging from the “usual” chain of command, since major changes often require working outside formalized systems. In a SME, the power of decision is centered on the leader, hence the importance of their involvement and support for the project to implement LM. What is more, the links are informal, which sometimes give a great deal of power to the actors without them having to be highly placed in the chain of command. This is often the case of workers who have been in the enterprise since it was founded.

5. CONCLUSIONS & RESEARCH PERSPECTIVES

The main contribution of this article is that it punctually highlights the conflicts between the management principles of LM and the characteristics of SMEs. The lack of resources, lack of expertise, short-term strategy, the lack of procedure and methods, and non-functional organization prevent the implementation of LM according to the 14 management principles set out by Liker (Liker, 2004).

The last point concerns the decision-making power that the chief executive of the SME centers around him/herself, as it is a key factor for the implementation phase.

We observed that the leader centralizes strong decision making power and expertise frequently acquired from previous experience of founding businesses and/or seniority. The resulting lack of delegation does not allow the expression or emergence of a leader in the company apart from the chief executive. Nonetheless, such leader ensures high level of interaction with the field (an important management principle of LM). This paradox represents both a strength and a weakness, for guiding change within the enterprise. It will be important in future research to measure the impact of the characteristics of the leader and the SME in the success of implementing LM. Some SMEs succeed in implementing LM, but do they possess the characteristics observed in most cases? Or do these rare successes occur in the rare advanced organizations that do not possess the weakness described above? Are the characteristics specific to the leader analyzed? Do they have a direct relationship with success?

It is difficult to find expertise and leadership in a SME other than in its chief executive and, as has been stated above, the implementation phase requires many qualities that SMEs lack. This translates to informal configurations lacking procedures in which the place of leaders is particularly important. Is this dimension taken into account in the implementations that succeed? Is the team responsible for managing change structured on the basis of these observations? What are the team’s characteristics during the implementations? The literature on these issues will be analyzed in order to confirm their impact.

Lastly, it has been shown that a SME is different from a large enterprise, with its strengths and weaknesses regarding LM as described here. How can advantage be drawn from these strengths to facilitate the implementation of lean culture with different tools, different steps and different milestones?

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