

Fostering Management Commitment towards Lean Manufacturing

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Abstract: Lean Manufacturing has always been associated with superior performance and industrial excellence. However, it consistently reported to have a high failure rate. Researchers have generally agreed that the reason behind those failures is the negligence of social aspects (soft practices) that are essential for Lean success. In efforts to identify the critical soft practices, management commitment turned out to be the root cause for Lean success or failure as it drives all other practices. The aim of this research is to provide a framework for fostering management commitment towards Lean, which in turn is believed to have a positive impact on Lean implementation. A systematic literature review was carried out followed by the development of a conceptual model that was empirically tested for measurement quality and hypotheses validation. Preliminary results of the model showed that management commitment is fostered through the development of Lean knowledge, strategic alignment between Lean strategy and organization strategy, and a performance measurement system for monitoring and feedback.

Keywords: Lean Manufacturing, Management Commitment, Lean Knowledge

1. Introduction

In light of nowadays tough global competition and scarcity of resources, organizations face big challenges in meeting customers and society requirements (Scherrer-Rathje, Boyle and Deflorin, 2009). Therefore, the practice of continuous improvement in operational efficiency becomes essential for organizations that aim to stay competitive in the market (Sim and Rogers, 2008). This is why the research of manufacturing improvement programs have gained a great sort of attention in the past three decades, with Lean Manufacturing gaining special attention being considered by many researchers and practitioners as the most dominant improvement program in manufacturing and operations management (Doolen *et al.*, 2008). However, despite associating Lean Manufacturing with improvements in operational performance, recent studies have reported that many organizations face challenges in their Lean attempts and fail to achieve the desired and expected outcomes; associating the reason for those failures to the act of neglecting the so-called Lean soft practices, that are the practices concerned with the human aspects in the Lean program (Costa *et al.*, 2019). Nevertheless, the studies have recognized management commitment to be one of the most critical soft practice and the steppingstone and cornerstone in any Lean implementation, as it drives all other soft practices that are essential for ensuring Lean success and sustainability (Ghobakhloo *et al.*, 2018; Costa *et al.*, 2019; Yadav *et al.*, 2019). The aim of this research is to leverage on the recent research findings and direct the focus towards the aspect of management commitment, for which there is evidence from literature that management commitment is pivotal in deciding the fate of Lean implementation. Management commitment is

considered the root cause behind Lean success or failure, and so it is considered important to study how management commitment towards Lean can be developed and sustained in the course of Lean implementation. Practitioners must understand not only the criticality of management commitment in the course of Lean implementation, but also the way for developing and sustaining such commitment. Therefore, this study provides the mechanism for fostering management commitment towards Lean, which in turn is believed to have a positive impact on the extent of Lean implementation, and consequently its success and sustainability.

2. Literature Review

Several case studies and empirical researches have highlighted the benefits of Lean Manufacturing and its impact on organizational performance, indicating that organizations who adopt Lean outperform those who do not; from an operational point of view (Netland, 2016). Lean's focus on the continuous removal of wastes with the aim of continuously improving the business value perceived by customers, has classified it as one of the most prominent improvement programs for improving business performance (Jagdish, Shankar and Santosh, 2014). This positive relationship between Lean and business performance has been evident in different sectors and countries across the globe, leading several academics and practitioners to recognize it as the most dominant paradigm in manufacturing and operations management (Doolen *et al.*, 2008), with some even indicating that Lean could soon become a qualifier in the manufacturing industry instead of just being a source of

competitive advantage (Boyle, Scherrer-Rathje and Stuart, 2011). However, despite the general consensus among researchers regarding the positive impact of Lean on business performance, several researches and reports have indicated that the majority of organizations who attempt to implement Lean fail in their implementation and move back to their old methods of production (Costa *et al.*, 2019). Scholars in the field of Operations Management have highlighted different reasons to the failure of Lean initiatives such as: Lean Manufacturing complexity, sole focus on Just-In-Time (JIT) practices while ignoring other important Lean practices, the presence of contingency factors that inhibit Lean efforts, and the negligence of human resource management (Bortolotti, Boscari and Danese, 2015). Yet, although researchers have reported different causes behind Lean implementation failures, the most cited and acknowledged cause is the neglect of the so-called Lean soft practices, which is the part in the Lean program that is concerned with human aspects. Bortolotti, Boscari and Danese (2015) explain that although Lean hard practices (tools and techniques) are crucial in the course of Lean implementation, they are still insufficient and require to be linked with Lean soft practices in order to achieve the desired and expected Lean outcomes. The outcomes of several studies have showed a positive relationship between Lean soft practices and the success of Lean implementation (Atkinson, 2010; Liker and Rother, 2011), which emphasize the fact that Lean is a socio-technical system that requires paying attention to both technical and human aspects, as these intertwined effects between technical (hard) and human (soft) aspects is what leads to the success and sustainability of the Lean program, consequently improving business performance (Wong, Ignatius and Soh, 2014).

In efforts to study the set of soft practices that would facilitate Lean implementation, several practices were identified such as: employee engagement, kaizen events, communication, etc. However, researchers have reached a general agreement that management commitment is one of the most critical soft practice in any Lean implementation (Achanga *et al.*, 2006; Scherrer-Rathje, Boyle and Deflorin, 2009; Netland, 2016). Management commitment is considered critical in the course of Lean implementation as it is the driver of all other critical success factors, which are all needed to achieve a successful and sustainable Lean implementation (Costa *et al.*, 2019; Yadav *et al.*, 2019). Boyle, Scherrer-Rathje and Stuart (2011) explain that for any improvement program to be effective and successful, it must be initiated from the top; by the management. This is echoed by Ghobakhloo *et al.* (2018) who emphasized that, in order for organizations to have successful and sustainable Lean implementations the initial focus must be always directed towards the development of management commitment towards Lean. The lack of management commitment in many organizations is usually due to the misconception that managements have regarding the concept and purpose of Lean. The level of knowledge and understanding of Lean has an effect on the level of management commitment towards the Lean program (McLean, Antony and

Dahlgaard, 2017). Clarifying the concept of Lean and communicating its advantages and relative importance to the organization would develop management motivation and commitment for the Lean program (van Assen, 2018). In addition, the management must receive trainings on Lean practices (hard practices) and become aware of all the factors (soft practices) that would facilitate or hinder Lean implementation, since not being able to apply the Lean tools and techniques or underestimating the extendedness of the Lean program would inhibit the Lean efforts (Åhlström, 1998; Moosa and Sajid, 2010) which would result in a lack of management commitment and motivation.

Apart from providing management with the adequate level of Lean knowledge, another important aspect that influence management commitment towards Lean is the alignment between the Lean strategy and the organization strategy. McLean, Antony and Dahlgaard (2017) highlight that management do not possess commitment for Lean when they have strategic priorities directed elsewhere. Dombrowski, Mielke and Schulze (2012) explain that the presence of any misalignment between the Lean philosophy and the enterprise strategy would lead to a lack of management commitment, which in turn would have a negative impact on Lean success and sustainability. Therefore, it is very important to assure that the Lean philosophy and strategy is always in alignment with the organization strategy, in order to have the management focused on the Lean program with full commitment. In other words, the idea is to have the Lean program as the mean for achieving the different goals of the organization, without any conflict. Moreover, aligning the Lean strategy with the organization strategy would allow for the integration of Lean with a group of management systems such as: IT systems and performance management systems, which are essential for data analysis and the support of the program implementation (Psychogios, Atanasovski and Tsironis, 2012). Speaking of management systems, it is evident that the presence of a performance measurement system which would continuously monitor the results and provide feedback on operational performance with respect to the set goals and targets, is essential for nurturing Lean sustainability (Marksberry *et al.*, 2010) and developing management commitment for Lean (Psychogios, Atanasovski and Tsironis, 2012). In fact, one of the main reasons behind the lack of management commitment is the management's lack of belief regarding the benefits that Lean Manufacturing can bring to the organization (Hernandez-Matias *et al.*, 2019). Case studies have showed that managers develop commitment for Lean only after observing the benefits brought by the Lean program (Yadav *et al.*, 2019). Therefore, the presence of a performance measurement system is fundamental in order to provide management with continuous feedback on operational performance to be able to observe the positive impact of Lean on business performance and develop a great level of commitment to the program. Setting organizational goals and targets and active steering on performance improvement metrics are essential management behaviors (Flynn and Saladin, 2001; Bourne, Kennerley and Franco-

Santos, 2005), that are believed to develop and sustain management commitment throughout the course of Lean implementation. It is evident from the extant knowledge reported in literature that providing management with the right level of Lean knowledge, aligning the Lean strategy with the organization strategy, and having a performance measurement system for continuous monitoring and feedback; are all important practices that would allow for fostering management commitment towards Lean, which is believed to positively impact Lean success and sustainability.

3. Methodology

The author decided to leverage on the wealthy literature available and adopt a deductive research approach, which is known to rely on highly structured methodology that would facilitate for the replication of results. For this purpose, a detailed systematic literature review was carried out with the objective of developing a conceptual model that would answer to the following research question: how to develop and sustain management commitment towards Lean throughout the course of Lean implementation? Moreover, the model aimed to study the direct relationship between management commitment and Lean implementation. For reviewing the literature, an advanced search was carried out using Scopus searching engine after identifying the target areas of research and key search terms: “Lean”, “Soft practices”, and “Management Commitment”, for which the key search terms were combined accordingly using the “AND” Boolean connector. The titles and abstracts (if necessary) of the articles obtained were reviewed, for which irrelevant articles were excluded. The papers selected (141) were then fully appraised based on their full text, in which the ones that were considered not useful were excluded, while other useful articles were added by applying the snowballing principle.

Based on the insights developed from the review of literature, a conceptual model composed of 5 latent variables (Lean Knowledge, Strategic Alignment, Performance Measurement System, Management Commitment, and Lean Implementation) was developed with respect to the research question and objectives.

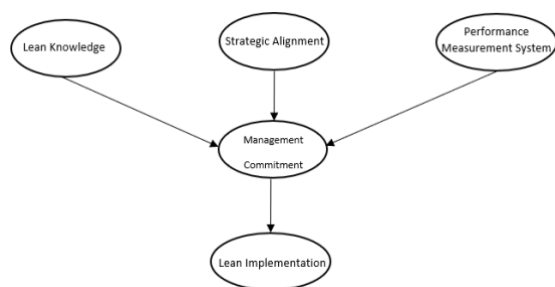


Figure 1. Conceptual model developed from literature review

The next step was to develop operational measures (manifest variables/questions/indicators) that would represent the 5 latent variables under investigation, for which all the questions were based on a 5-Point Likert scale. It was hypothesized that each of the variables Lean Knowledge, Strategic Alignment, and Performance Measurement System positively contributes to Management Commitment, and that Management Commitment positively contributes to Lean Implementation, that is a total of four hypotheses to be tested. Manifest variables that explain the five latent ones were identified from the survey of the literature and went to build the questionnaire.

For example Lean Knowledge (LK) must be conveyed throughout the organization; and at all levels, in order to ensure that all individuals in the organization have developed the right understanding of Lean (Dombrowski, Mielke and Schulze, 2012). Lean programs are more effective when organizations are aware of the concept of Lean and the benefits that it brings (van Assen, 2018). Moreover, every organization should see the need for implementing Lean and not just adopt it to copy other firms (Beer, 2003). It is very important for an organization to understand the reasons for implementing Lean and to have the desire for adopting it (Soltani, Lai and Gharneh, 2005). After having individuals in an organization who understand the purpose of Lean and believe in its importance to their organization, it is then important to train those individuals on Lean tools and practices which would help develop their confidence towards the implementation of Lean and make them more involved (Hernandez-Matias *et al.*, 2019). It is also believed that an organization would develop more confidence for Lean if they become aware of other organizations who improved because of Lean. Boyle, Scherrer-Rathje and Stuart (2011) highlight that, the more a management of an organization is exposed to literature for which they become aware of Lean benefits and challenges, the more they will commit to its implementation, indicating that such exposure could be captured by attending trainings, conferences, visiting other plants, etc. It is critical to make sure that an organization’s management is fully aware of the factors that would facilitate or hinder Lean implementation, since underestimating the complexity and extendedness of the Lean paradigm; that is related to the adoption of both hard and soft practices, would just lead to its failure (Hines, Holwe and Rich, 2004).

Therefore, the independent variable Lean Knowledge is thought to represent the level of knowledge that an individual (manager) possesses regarding Lean Manufacturing, which is characterized by the following aspects: understanding the benefits of Lean and its importance to the organization where the manager is part of, the recognition of Lean success stories, understanding how to apply Lean tools and techniques, and being aware of the factors that facilitate or hinder Lean implementation. For the purpose of measuring the concept of Lean Knowledge, five questions were developed (see Appendix).

The methodological steps that were followed are summarized in Figure 2.

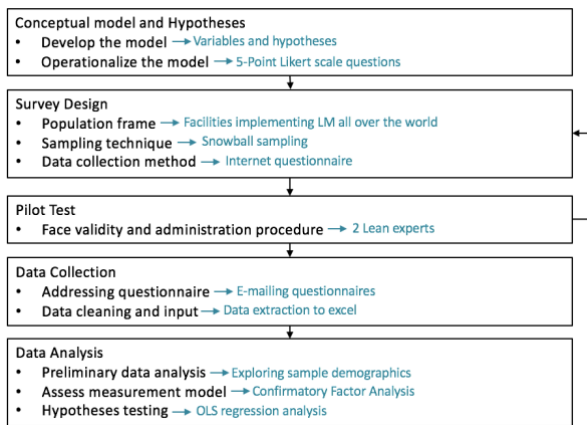


Figure 2. Methodological steps after literature review

The target population of the questionnaire were facilities implementing Lean Manufacturing all over the world regarded as the target population frame, a snowball sampling technique was adopted to obtain a sample that could represent the population; considering the time and resources constraints and the difficulty in identifying population elements with respect to the wide population frame. A survey research strategy was adopted to allow for the collection of large amounts of data, from a large population, and in a reasonable period of time. For this purpose, an internet self-administered questionnaire was used as the measurement instrument for addressing the survey to the sample elements. It worth mentioning that since the population frame under study is quite wide indicating that the population might be holding elements of different properties and characteristics, a set of control variables were introduced in the measurement instrument on the basis of a nominal scale, in order to account for any potential variability that might result from such a wide population. The choice for the questionnaire as the survey instrument is aligned with the objective of the study and the corresponding research choice; mono-method quantitative, in which quantitative data is collected to be statistically analyzed for testing the hypothesized model accordingly. For the purpose of this research, and with respect to the time and resources constraints, the very large population frame, and the difficulty in identifying population elements, it was decided to adopt a snowball sampling technique (non-probability sampling technique), which is still believed to obtain a sample that could represent the population under study. Experts and practitioners in the field of Operations Management; Lean Management, were approached randomly through the LinkedIn professional platform, and were asked to recommend other potential respondents who could also qualify to participate in the survey. The internet self-administered questionnaire allowed for collecting data in a timely manner and a highly economical way, with 122 responses were received for which 91 out of the 122 responses were complete and valid for statistical analysis.

After cleaning and inputting the data collected, a preliminary data analysis (exploratory analysis) was carried

out to draw a picture on the nature of the data collected and the properties and characteristics of the sample from which that data is obtained (sample demographics). All control variables were analyzed. The industry of the company in the sample is presented below in Figure 3 as example. The preliminary data analysis was then followed by a confirmatory factor analysis which aimed to assess the measurement quality of the hypothesized model, that is to check if the hypothesized model is reliable and valid for hypotheses testing. After assessing the reliability and validity of the measurement model, ordinary least squares regression analysis (simple linear regression, multiple linear regression, and hierarchical regression) was then applied in order to test the four hypotheses underlying the operationalized conceptual model.

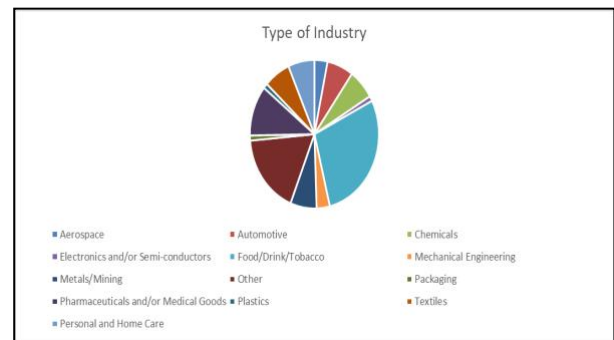


Figure 3. Industry distribution for company’s respondent

4. Preliminary results

The Confirmatory Factor Analysis was performed in order to validate the five latent variables. In Table 1, the Cronbach’s Alpha for each latent variable is presented. Since all values are higher than 0,7 (Nunnally, 1978), the latent variables were considered as reliable.

Construct	Cronbach’s Alpha (α)
Lean Knowledge (LK)	0.75
Strategic Alignment (SA)	0.73
Performance Measurement System (PMS)	0.86
Management Commitment (MC)	0.78
Lean Implementation (LI)	0.81

Table 1. Cronbach’s Alpha for each latent variable

After that Ordinary Least Square regression was used to assess the four hypotheses under research question: Lean Knowledge, Strategic Alignment, and Performance Measurement System all have a positive effect on Management Commitment, and that Management Commitment in turn has a positive effect on Lean implementation. Ordinary least squares regression is a statistical method of analysis that estimates the relationship between one or more independent variables and a dependent variable according to the principle of least squares; that is minimizing the sum of the squares of the differences between the values observed for the dependent variable from the dataset and those predicted by the linear function. While simple linear regression estimates the relationship between two variables, multiple

linear regression on the other hand estimates the relationship between two or more independent variables and a dependent variable. This type of analysis was adopted for hypotheses testing as it allows for studying both single relationships and multiple relationships, in addition to mediating and moderating relationships between variables, allowing for developing clear and concise understanding regarding the relationships between the different independent and dependent variables under study. Recalling the model under study, it was required to test the relationship between three independent variables (Lean Knowledge, Strategic Alignment, and Performance Measurement System) and Management Commitment as the dependent variable. Moreover, it was also required to test the relationship between Management Commitment as an independent variable and Lean Implementation as the dependent variable.

With respect to the above explained objectives, several regression analyses of different types were carried out, as explained below:

- Multiple regression analysis to test the relationships between the three independent variables (Lean Knowledge, Strategic Alignment, and Performance Measurement System) and Management Commitment, referred to as “Model 1”.
- Simple linear regression analysis to test the relationship between each of the three independent variables and Management Commitment (dependent variable), referred to as Models “1A”, “1B”, and “1C”, as indicated below:
 - Model 1A: Lean Knowledge and Management Commitment
 - Model 1B: Strategic Alignment and Management Commitment
 - Model 1C: Performance Measurement System and Management Commitment
- Simple linear regression analysis to test the relationship between Management Commitment (independent variable) and Lean Implementation (dependent variable), referred to as “Model 2”.

Results of model 1A are shown in Table 2.

Moreover, the regression analysis has showed that although the relationship between Lean Knowledge and Management Commitment showed to be positive and significant in the simple linear regression model, this relationship turned out to be insignificant in the multiple linear regression model that included all independent variables. This interesting finding has been explained after performing hierarchical regression analysis, which have showed that each of the variables Strategic Alignment and Performance Measurement System partially mediates the relationship between Lean Knowledge and Management Commitment, and that both variables together fully mediate the relationship between Lean Knowledge and Management Commitment.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.583 ^a	.339	.332	5598047077	.339	45.746	1	89	.000

a. Predictors: (Constant), LK

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta				Tolerance	VIF
1	(Constant)	1.133	.406			2.788	.006		
	LK	.660	.098	.583		6.764	.000	1.000	1.000

a. Dependent Variable: MC

Table 2. Results of Model 1A

5. Research Implications

This research reports some theoretical and practical implications that provide key contributions to both research and practice. The research has developed four new constructs for measuring the four following aspects: Lean Knowledge, Strategic Alignment, Performance Measurement System, and Management Commitment, in which all four constructs showed to be reliable and valid. These constructs are considered to be of high usefulness for researchers who might wish to study any of these aspects in any of the future researches. Moreover, the research adds to the existing body of knowledge by confirming empirically that the three practices: Lean knowledge, Strategic Alignment, and Performance Measurement System, positively contribute to Management Commitment, while also explaining the mediating role played by Strategic Alignment and Performance Measurement System. Not to mention that, it also confirms empirically that Management Commitment positively contributes to Lean Implementation. In addition, the research highlights that both the organization business operating model and in some cases the type of industry in which the organization operates, have an effect on the level of management commitment, which raises a call for researchers to investigate this subject and study the effect of contextual factors that would be a topic of high relevance and interest to the Operations Management and Lean community. The research also provides practitioners and decision makers with a framework (model) of practices that would foster management commitment throughout the Lean implementation. The model suggests that management commitment should be fostered through two sequential stages (steps), in which the first stage is to provide management with an adequate level of Lean knowledge, while the second stage is to align the Lean strategy with the organization’s strategy and have in parallel a performance measurement system which would provide regular feedback on performance. The respect model explains that while the first stage develops management commitment towards Lean, the second stage sustains management commitment over time, and so both stages together ensure the fostering of management commitment throughout the course of Lean implementation.

Nevertheless, the research outcomes send a message to all managers who attempt to implement Lean Manufacturing; that is to hold continuous commitment for the Lean program. The study has highlighted the importance of management commitment by emphasizing the direct relationship between management commitment and the extent of Lean implementation (application of hard and soft practices), which would in turn decide on the success or failure of Lean implementation. Therefore, the direct and significant positive relationship between management commitment and Lean implementation raises a flag to all practitioners and serves as an empirical evidence for those who might have doubted the criticality of management commitment, and its pivotal role in deciding the fate of any Lean implementation.

Finally, another practical implication provided in this research is regarding the effects of contextual factors on management commitment. The results have showed that the business operating model and some types of industries have an effect on management commitment, indicating that certain contextual factors could influence Lean success and sustainability. These insights raise an awareness regarding this subject, for both researchers and practitioners, urging them to start considering the aspect of contextual factors, and add it to the equation along with hard and soft practices, with the purpose of forming a comprehensive image that could reflect all the challenges faced by an organization who attempt to implement Lean Manufacturing.

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Number of years in which the company has been implementing Lean
Number of years in which the respondent has implemented Lean (in any organization)

Table 3. List of control variables

Lean Knowledge
Management believes that Lean improves business performance and increases customer satisfaction
Management believes that we must implement Lean if we want to stay competitive in the market
Management knows about organizations that improved their performance, gained several benefits and became more competitive by implementing Lean
Management received trainings on Lean practices (ex: Pull, Flow, TPM, etc.)
Management attended trainings/conferences/seminars about factors that facilitate or hinder Lean implementation (ex: bottom-up approach, resistance to change, etc.)

Table 4. List of Lean Knowledge manifest variable

Appendix.

Factory location
Organization type of ownership (public, private or family owned)
Type of industry
Business operating model (business to customer, customer to customer or mixed)
Operations strategy (purchase-to-order, make-to-order, make-to-stock, etc.)
Age of the organization
Number of employees working in the factory