Journal of Optimization in Industrial Engineering
Vol.16, Issue 1, Winter & Spring 2023, 225–229
DOI: 10.22094/JOIE.2023.1973882.2018.

Research Article

The Barriers and Critical Success Factor for Implementing Lean Manufacturing at SMEs

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Received 08 November 2022; Revised 05 April 2023; Accepted 10 April 2023

Abstract

Small Medium Enterprise (SME) gives a big pressure on the management of their assets. Lack of expertise and awareness will become the major obstacles in achieving a better business strategy. Lean principles are applied in manufacturing and service industries extensively, but its success application in industry has been poor. The main objective of this study is to identify the Barrier for implementation of Lean Manufacturing (LM) at SMEs and to determine the Critical Success Factors (CSFs) for Implementation of Lean Manufacturing (LM) at SMEs. The data was collected using questionnaire and all the data was analyzed by using SPSS. There are 208 respondents involved in this study and the questionnaire is accepted with Cronbach's Alpha more than 0.7. From the new conceptual model created after KMO and Bartlett's Test, the researchers show there is one construct eliminated for both CSFs and Barriers. This study found that the construct for the Barrier for implementation of Lean Manufacturing at SMEs were related to resources, management, knowledge and financial. The construct for the CSFs for Implementation of Lean Manufacturing at SMEs were related to responsibility & leadership, supplier, people management and resource. The proposed model from this study will only be suitable for SMEs in Pasir Gudang Industrial area.

Keywords: Lean Manufacturing Implementation; Critical Success Factor; Barrier

1. Introduction

Turn over new leaf, front global has to indicate many manufacturing firms to embrace new manufacturing management strategies to improve the firm viability and sustainability. In this exploration, it concentrated on the obstruction and basic achievement factor for executing Lean Manufacturing at SMEs in Malaysia. This investigation gives specific consideration to decide the difficulties looked by SMEs in executing Lean Manufacturing. Nowadays, to endure and create organization activities in an undeniably serious climate, small and medium enterprises (SMEs) need to oversee issues like cost decrease and persistent execution improvement. Productivity and improvement of the product are a must for any company. The application of lean manufacturing has been implemented in the industry regardless of whether small industry or big industry. Lean principles are applied in manufacturing and service industries extensively, but its success application in industry has been poor (Shrimali & Soni, 2017). However, numerous SMEs are helpless in that they work in areas where there are scarcely any hindrances to new contestants and where they have little capacity to communicate directly to providers on their requirements. This would greatly impact on productivity and improvement to SMEs themselves.

2. Literature Review

Nowadays, the term "Lean" can be found almost everywhere such as lean entrepreneurship, lean services, lean accounting, lean product development, lean software development and the list goes concept is the same as maximize the customer value with minimum waste such manufacturing or delivering more with less(Awwad, 2021).

SMEs in Malaysia are decidedly added to the improvement of the Malaysia economy and accomplishment of big-time salary country status in year 2020. It assumes a significance part in the advancement of the Malaysia economy in 2010, contributing 99.2% of complete business foundations in Malaysia, with a 32% portion of work and 19% portion of absolute fare which is SME Masterplan 2012 until 2020. These figures exhibit the significance of SMEs in molding Malaysian monetary scene (Ramadas & Satish, 2018), (Zahraee, 2016), (Knol, Slomp, Schouteten, & Lauche, 2018), (Elkhairi, Fedouaki, & El Alami, 2019),(Belhadi, Touriki, & Elfezazi, 2018), (Gaikwad, Paul, Moktadir, Paul, & Chowdhury, 2020), (Chaple, Narkhede, Akarte, & Raut, 2021), (Jaiswal, Singh, Misra, & Kumar, 2021) .

2.1 Barriers

This study compiled all the factors related to the barriers for implementation of Lean Manufacturing at SMEs from the previous study starting from 2014 until 2020. Figure 2.1 summarized the findings form 8 journals in form of conceptual model. There are 5 main constructs in this factor which are employees, resources, financial, knowledge and management. Resistance to change was found as the highest frequency stated in previous study (Dora, Kumar, & Gellynck, 2016).

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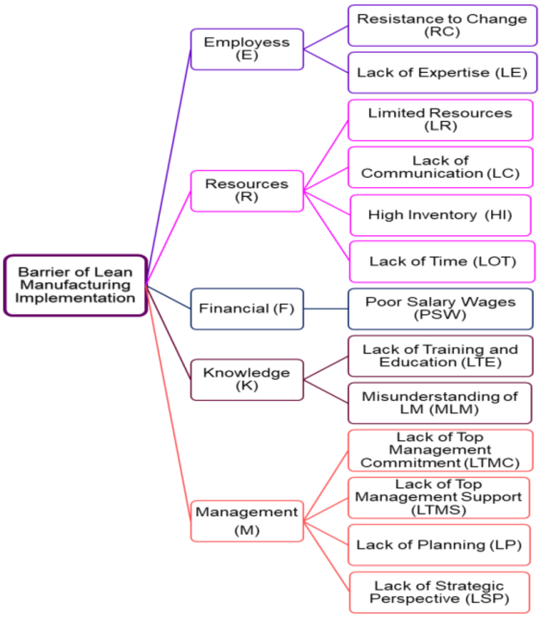

Fig. 1. Barriers for LM Implementation at SMEs

2.2 Critical success factors (CSFs)

This study compiled all the factors related to the Critical Success Factors (CSFs) for implementation of Lean Manufacturing at SMEs from the previous study starting from 2013 until 2019. Figure 2.2 summarized the findings form 8 journals in form of conceptual model. There are 5 main constructs in this factor which are people management, management responsibility and leadership, customer management, resources management and supplier management. Top management was found as the highest frequency stated in previous study (Netland, 2016), (Dora, Kumar, Van Goubergen, Molnar, & Gellynck, 2013), (Abu, Gholami, Saman, Zakuan, & Streimikiene, 2019).

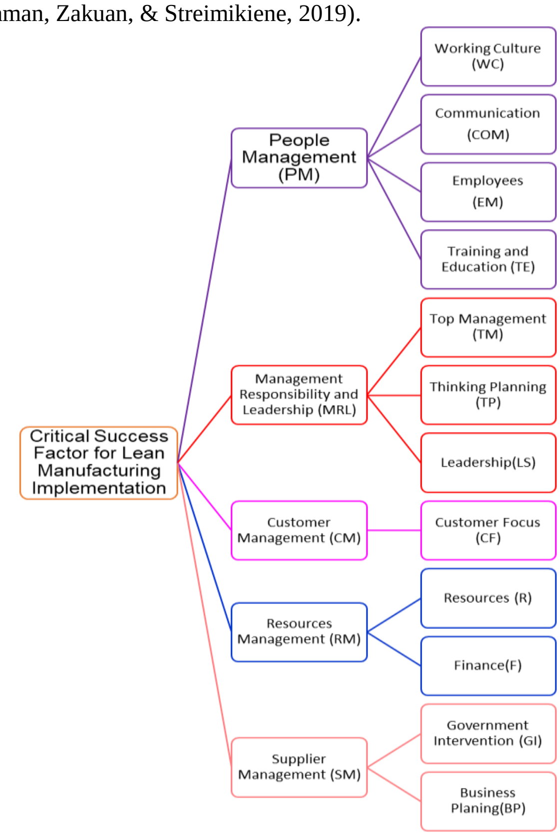

Fig. 2. CSFs of LM Implementation at SMEs

3. Methodology

Survey questionnaire empowers the researchers to evaluate all the respondents by a similar instrument and under similar conditions (Salonitis & Tsinopoulos, 2016). By using Krejcie and Morgan table, the sampling size of this study is 205 respondents.
The researchers used SPSS software to analyse the data from respondents. The test that researchers used to interpret the data is reliability test, T-Test, Normality test, KMO and Bartlett Test and Exploratory Factor Analysis (EFA).

4. Result and Discussion

In this research, the data collected has been analysed by using SPSS software. The data was analysed according to the following steps:

- Pilot Testing
- Reliability Testing
- Outlier
- Normality Testing
- Non–Response Bias Testing
- KMO and Bartlett's Test
- Exploratory Factor Analysis (EFA)

4.1 Pilot testing

Table 1 shows that the result of pilot test is 0.878. The targeted Cronbach's Alpha value is 0.7 and above. This means that the questionnaire could be used for the study as the Cronbach's Alpha is beyond 0.7.

Table 1
Reliability Statistics for Pilot Test CSF

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.878	.885	20

For barrier, the result was 0.923, so the Cronbach's Alpha value is accepted. So, the results are achieved because the Cronbach's Alpha value are more than 0.7

Table 2
Reliability Statistics for Pilot Test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.921	.923	18

4.2 Reliability test for full survey

Table 3
Reliability Statistics for Full Survey

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.878	.874	29

From table 4.3, the data of reliability test for full survey has achieved Cronbach's Alpha. The targeted Cronbach's Alpha value is 0.7 and above. The result was 0.874, so the Cronbach's Alpha value are accepted.

4.3 Non – response bias

For non–response bias between late and early respondent, this study has collected 50 early respondents and 50 late respondents as follow the pilot test requirements which is 25 until 50 respondents that shall be tested in this test. It has no rule of thumb for this non-response bias but the results from the Table 4.3 shows a good result from the overall 50 early respondents and 50 late respondents. For this research, both critical success factor and barrier are normal which is p value are more than 0.05 by using independent testing.

4.4 Outliers

According to multivariate and univariate outliers, no data was removed. If the normality expectation is not fulfilled, Kumar, (2014) recommends examining and excluding extreme outliers. However, since the normality testing in this study was successful, the removal of the outlier might not be appropriate. The multivariate outlier is assessed using Mahalanobis d-square distance, and the result in the p2 column should be greater than 0.05 (Kumar, 2014). A univariate outlier is measured using SPSS by looking at the standardized Z-value of both constructs and whether the standard score for the broad-scale is greater than 80 and is +/- 4 standard deviation away from the mean.

Due to multivariate and univariate outliers, some variables were eliminated. When the normality assumption is violated, Kumar, (2014) recommends inspecting and excluding extreme outliers. The details of 4, 8, 115, and 188 were only eliminated at multivariate outliers.

4.5 Normality testing

Normality test is decided to utilize if the sample of data has been drawn from a normal distributed population that included some tolerance or resistance. It was used to identify whether the data collected is very well displayed by normal distribution and to process how likely it is for an irregular or random variable data to be normal distribution.

In this normality testing, the skewness was found to be within the range of -1.0 to 1.0, and the Critical Ratio (CR) for skewness was found to be within the range of -3.0 to 3.0. Kurtosis' Critical Ratio (CR) was in the ratio of -7.0 to 7.0.

4.6. Exploratory factors analysis (EFA)

The Exploratory Factor Analysis was used to determine the factors based on the feedback from the respondents.

4.6.1. Measure of sampling adequacy for CSF

The significance of Kaiser – Meyer – Olkin is 0.695, according to Table 4.4. The KMO values are more significant than 0.5, and the results are suitable for this study. Furthermore, it is an indicator of sampling adequacy, which means the fundamental conditions induced the variation in the variables. As a result, the use of factor analysis is permitted, as shown by Bartlett's examination of sphericity values of 0.00 or less than 0.05.

Table 4
KMO and Bartlett's Test for CSF

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.695**
Bartlett's Test of Sphericity	Approx. Chi-Square	1034.156
	df	91
	Sig.	.000

4.6.2 Rotated component matrix to group variable for csf

Table 4.5 are shown the result of Rotation Component Matrix for CSF and displaying new construct. There are 4 constructs were identified to be presented with 2 items not listed and 14 remains.

Table 5
Rotation Component Matrix for CSF

	Component			
	1	2	3	4
C_PM_TE			.773	
C_PM_COM1		.526	.545	
C_PM_EM			.798	
C_PM_WC1			.677	
C_MRL_TM	.580			
C_MRL_LS		.608		
C_MRL_TP	.677			
C_RM_F1				.655
C_RM_R1				.730
C_CM_CF1				
C_CM_CF2				.837
C_CM_CF3				
C_SM_BP1	.695			
C_SM_GI		.844		

From the result above, new conceptual model as shown in Figure 4.1 for was proposed for Critical Success Factors (CSFs) for Implementation of Lean Manufacturing (LM) at SMEs in Pasir Gudang Industrial area.

4.6.3 Measure of sampling adequacy for barrier

According to Table 4.6, for the Barrier for implementation of Lean Manufacturing (LM) at SMEs, the significance of Kaiser – Meyer – Olkin is 0.690, The KMO values are more significant than 0.5, and the results are suitable for this study. As a result, the use of factor analysis is permitted, as shown by Bartlett's examination of sphericity values of 0.00 or less than 0.05.

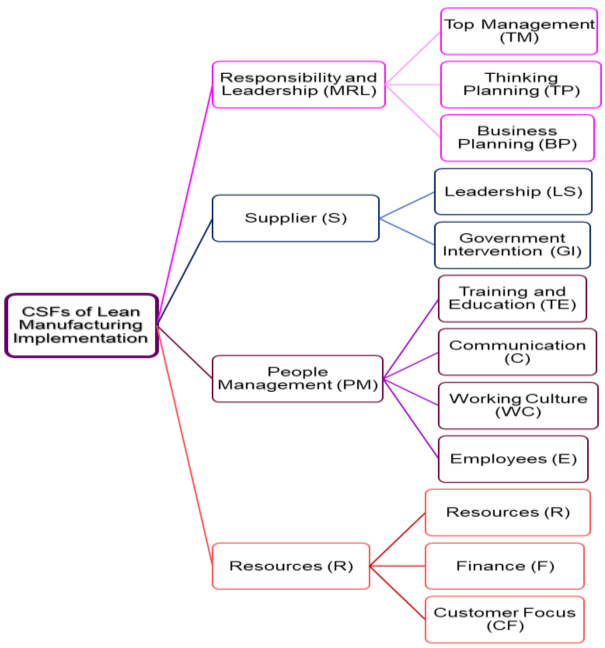

Fig. 1. New Conceptual Model for CSF

Table 6
KMO and Bartlett's Test for Barrier

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.690
Bartlett's Test of Sphericity	Approx. Chi-Square	1467.468
	df	105
	Sig.	.000

4.6.4 Rotated component matrix to group variable for barrier

Table 4.7 are shown the result of Rotation Component Matrix for CSF and displaying new construct. There are 4 constructs were identified to be presented with 2 items not listed and 15 remains.

Table 7
Rotation Component Matrix for Barrier

	Component			
	1	2	3	4
B_E_RC		.551		
B_E_LE	.678			
B_R_LR	.572	.598		
B_R_LC	.651			
B_R_HI		.681		
B_R_LOT	.648			
B_K_LTE			.514	
B_K_MLM		-.620	.590	
B_M_LTMC		.724		
B_M_LTMS	.692	-.542		
B_M_LP		.536		
B_M_LSP				
B_F_PSW1				.577
B_F_PSW2				.550
B_F_PSW3				

From the result above, new conceptual model as shown in Figure 4.2 for was proposed for the Barrier for implementation of Lean Manufacturing (LM) at SMEs in Pasir Gudang Industrial area,

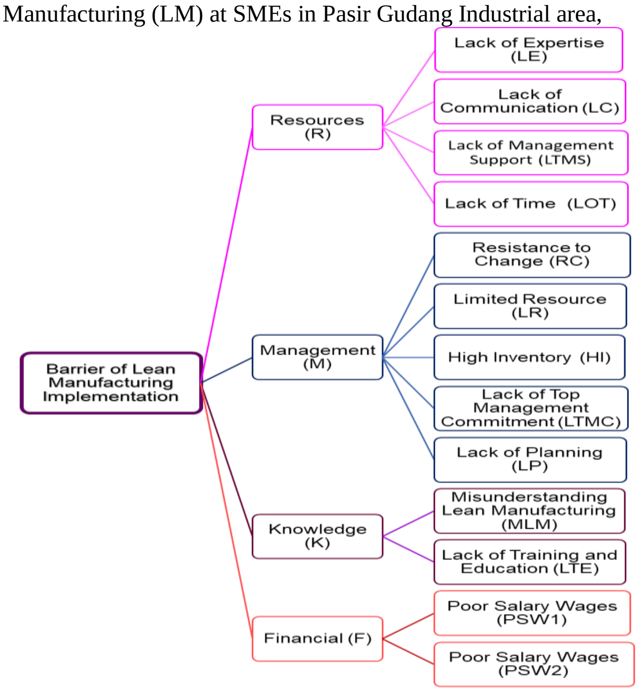

Fig. 2. New conceptual model for barrier

5. Conclusion

This study found that many of the items in the questionnaire have shown to be suitable and comprehensible. The findings in this study show that there are 4 main constructs for the Critical Success Factors (CSFs) for Implementation of Lean Manufacturing (LM) at SMEs in Pasir Gudang Industrial area that consist of 14 important factors.

For the Barrier for implementation of Lean Manufacturing (LM) at SMEs in Pasir Gudang Industrial area, there are 15 important factors that were categorized into 4 main constructs.

5.1 Recommendation for future research.

Future research can be conducted with larger sample size and bigger scope, as this study limitation only applicable to the SMEs in Pasir Gudang Industrial.

It is also suggested to conduct the study in specific industry such as electrical & electronic industry or manufacturing industry, because the intended paradigm for different industry may have different approaches to execution and views of Lean Manufacturing implementation.

Acknowledgement

An exceptional thanks to my kind corresponding author Ts. Dr. Hj. Mohd Amran B. Mohd Daril, who has provided great supervision, advice and guidance. This research project would not been success without his constant support and concern.

Not to forget to Prof. Dato' Dr. Khairanum Subari, Ir. Ts. Dr. Mohamad Ikbar Abdul Wahab, Dr. Latipah Nordin and Dr. Sara Berraies for input given to increase the understanding toward the topic. Your kind contribution was much appreciated. The research reported in this paper was supported by the Short-Term Research Grant (STRG) No. UniKL/CoRI/str19057 awarded by Universiti Kuala Lumpur, Malaysia.

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This article can be cited: Mohd Daril, M. A., Mohamad Fadeli, S. F., Abdul Wahab, M. I., Subari, K., Nordin, L., & Queshi, M. I. (2023). The Barriers and Critical Success Factor for Implementing Lean Manufacturing at SMEs.
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