MJIT 2022 **Malaysian Journal of Industrial Technology**

A STUDY OF CRITICAL SUCCESS FACTORS FOR IMPLEMENTING LEAN MANUFACTURING IN MALAYSIAN AUTOMOTIVE INDUSTRY

S. H. Mazlan
Quality Engineering Section, Malaysian Institute of Industrial Technology, University Kuala Lumpur, Johor, Malaysia.
sarah.mazlan19@s.unikl.edu.my

M.A.M.Daril
Quality Engineering Section, Malaysian Institute of Industrial Technology, University Kuala Lumpur, Johor, Malaysia.
mamran@unikl.edu.my

M.Awang
Quality Engineering Section, Malaysian Institute of Industrial Technology, University Kuala Lumpur, Johor, Malaysia.
mazlana@s.unikl.edu.my

*Corresponding author's email: sarah.mazlan19@s.unikl.edu.my
mamran@unikl.edu.my
mazlana@s.unikl.edu.my

ABSTRACT

Lean manufacturing (LM) has drawn a lot of attention in the automotive sector for achieving high levels of production, and it is now recognized as the normative manufacturing approach for the 21st century. Lean manufacturing aims to offer a smooth manufacturing flow by raising productivity to the level of high-quality items, maximizing the utilization of production labor, cutting manufacturing costs through a continuous improvement process, and reduce delivery times. As a result, it helps businesses achieve their objectives and profit from the environment. As a result, the application of Lean Manufacturing (LM) in the Malaysian automotive industry is the main emphasis of this study. This study's goal is to rate each CSF's Critical Success Factors (CSF) in order of importance for the implementation of lean manufacturing. The development of a conceptual model of CSF for the application of lean manufacturing in the sphere of the automotive industry is another goal of this study. This study's methodology uses a quantitative, questionnaire-based approach. the creation and delivery of a structured questionnaire to a sizeable portion of Malaysia's automotive industry Using SPSS software, which includes the Reliability Test, Normality Test, KMO & Bartlett's Test, Friedman Test, and Exploratory Factor Analysis, the degree of CSF for Lean Manufacturing Implementation in the Automotive Industry is assessed and analyzed (EFA).

Keywords: *Lean Manufacturing; Critical Success Factors, Automotive Industry; Lean Application.*

1.0 INTRODUCTION

The automobile industry, according to [5] is one of the most active in terms of quality assurance, affordable manufacture, and ongoing improvement. Eliminating any waste that drives up the cost of a good or service is one of the main concepts of the lean movement [15]. Lean manufacturing (LM) has gained a lot of attention in the automotive sector for achieving high levels of production, and it is now recognized as the normative manufacturing approach for the 21st century [12]. Malaysian manufacturers have struggled to meet consumer expectations, deal with fluctuating demand, and improve supplier capacity [16]. Continuously implementing lean offers the benefit of speeding up the manufacturing process, enhancing product quality, and raising customer happiness, claim [6]. Therefore, one of the concepts for reduction of waste is from lean manufacturing [9]. Aside from that, lean manufacturing (LM) is regarded to be the most effective strategy for all sectors [10]. The adoption of Lean Manufacturing within a single firm is possible with the aid of crucial success factor (CSF). Critical success factor (CSF) identification inside the organisation is essential [17]. Thus, to know if the factors that plays crucial role in the successfulness of lean manufacturing practiced are similar or not, a short survey involving well- versed and experienced persona with different backgrounds in was conducted to get some indicators regarding critical success factors of Lean Manufacturing implementation in their companies [11].

The ultimate objectives of this study are focus on Critical Success Factors for Implementing Lean Manufacturing in Malaysian Automotive Industry. Basically, this study has three main objectives which; to identify the Critical Success Factors (CSF) for Implementing Lean Manufacturing in Malaysian Automotive Industry. Besides, this study aims to determine highest ranking of CSF of Malaysian Automotive Industry through implementation of Lean Manufacturing. Last but not least, it is also to develop a conceptual model of CSF for Implementing Lean Manufacturing in Malaysian Automotive Industry.

2.0 LITERATURE REVIEWS

2.1 Critical Success Factors (CSF)

The study of information systems during the past two decades demonstrates that the CSFs technique has been widely embraced and applied in a number of subject areas to identify the most important variables affecting a company's success [13]. Since there is no single definition of success and that it varies from person to person, several definitions of important success criteria have been attributed to them, depending on the perspectives of various [14]. Rockart defined critical success factors as the small number of areas in which results, if good, will assure a successful competitive performance of the organisation and the small number of important areas in which things are going well for that the successful firm [14].

2.2 Lean Manufacturing (LM)

According to [3] Lean is a methodical approach to reducing waste in a manufacturing line in a productive, reliable, and cost - efficient way. It defines waste as anything that raises the price of the product, such as lost labor time, excessively high levels of movement, or extra steps taken during the production process. Based on [1] Using this methodology has been demonstrated to have a variety of potential advantages, including a reduction in the amount of work-in-process inventory and a reduction in the lead time required to manufacture each screen (partially finished goods awaiting completion).

It is generally accepted that Toyota Motor Corporation (Toyota) created lean to boost productivity following World War II. As a result, Toyota developed a technique they termed the Toyota Production System to continuously increase the productivity of their plants (TPS). The corporation was able to cut prices thanks to the TPS to compete with the relatively cheap German and American cars. It is from TPS that the principles of Lean Manufacturing Methodology were later derived.

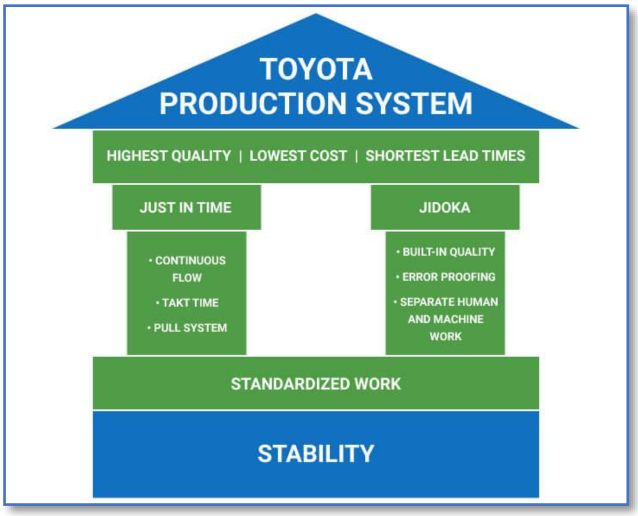

Figure 2.1 An overview of the Toyota Production System

The Toyota Production System, and later the concept of Lean, was developed around eliminating the three types of deviations that show inefficient allocation of resources. The three types are Muda (waste), Mura (unevenness), and Muri (overburden) – refer table 2.1. Eliminating *muri* (overburden), *mura* (inconsistency) and *muda* (wastes) improves production processes. According to [8] To achieve this, it is vital to stop all wasteful actions, such as unnecessary transportation, unnecessary movement, and all types of stocks that would raise costs. The global automotive industry has made lean production a standard, and other industrial industries are gaining ground in other manufacturing sectors as well [2]. The identification and elimination of non-value-adding jobs as well as the reduction of inventory were all driven by the emphasis on waste reduction [4].

Table 2.1 Description of LM 7 wastes [7]

	Type of Waste	Description
1	Overproduction	Producing too much or too soon, resulting in poor flow of information or goods and excess inventory.
2	Defects	Frequent errors in paperwork, product quality problems, or poor delivery performance.
3	Unnecessary inventory	Excessive storage and delay of information or products, resulting in excessive cost and poor customer service.
4	Inappropriate processing	Going about work processes using the wrong set of tools, procedures or systems, often when a simpler approach may be more effective
5	Excessive transportation	Excessive movement of people, information or goods resulting in wasted time, effort and cost
6	Waiting	Long periods of inactivity for people, information or goods, resulting in poor flow and long lead times.
7	Unnecessary motion	Poor workplace organisation, resulting in poor ergonomics, eg excessive bending or stretching and frequently lost items.

2.3 Summary related to Critical Success Factors of Lean Manufacturing implementation in Automotive Industry

Table 2.2 CSF of Lean Manufacturing implementation based on previous study

Critical Success Factors (CSF)	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	TOTAL
Leadership	/			/	/	/		/				/	/			7
Structure improvement procedure	/															1
Supplier Relationship	/											/		/		3
Quality information and Analysis	/															1
Just-in-time	/		/													2
Customer focus	/		/	/										/		4
Focus on metric	/						/									2
Manufacturing process		/														1
Supply chain management		/	/	/												3
Social responsibility		/														1
Environmental management		/												/	/	3
Top Management involvement					/		/	/		/	/	/	/	/		8
Cultural Change					/										/	2
Organizational Culture					/			/					/			3
Quality management				/												1
Effective communication				/		/			/	/			/	/	/	7
Continuous improvement				/		/	/		/			/		/		6
Team Formation						/	/		/					/		4
Lean Training & Education				/	/		/	/		/	/		/	/	/	9
Project management & planning					/			/								2
Skills and expertise								/								1
Employee Commitment			/	/				/			/			/	/	6
Good Lean tools								/								1
Efficient use of resources									/							1
Elimination of waste									/							1
Monitoring progress					/					/						2
Customer Link												/				1
Reward & Recognition					/									/		2
Statistical Process Control			/													1
Simultaneous Development						/										1

The researcher searched for roughly 15 articles and theoretically drafted it in a table. The above data demonstrates that Lean training and education have the highest frequency of 9. Top management engagement is next with a frequency of 8, which is the second highest frequency. The introduction of lean manufacturing in the automotive industry is then considered in light of the equation perspective of 7 areas within leadership and effective communication. Other than that, the journals regarding CSF of Lean Manufacturing implementation also highlighting about Structure improvement procedure, Supplier Relationship, Quality information analysis, JIT, Customer focus, Focus in metric, Manufacturing process, Supply chain management, Social responsibility, Environmental management, Top management involvement, Cultural change, Organizational culture, Quality management, Continuous improvement, Team Formation, Project management & planning, Skills & expertise, Employee Commitment, Good Lean tools, Efficient use of resources, Elimination of waste, Monitoring progress, Customer link, Reward recognition, Statistical process control, and Simultaneous development.

Right after doing some readings, the researcher selects and categorized the factors into 7 constructs and develop a Conceptual Model for Critical Success Factor Lean Manufacturing Implementation in Automotive Industry. Below is the visualization of the model.

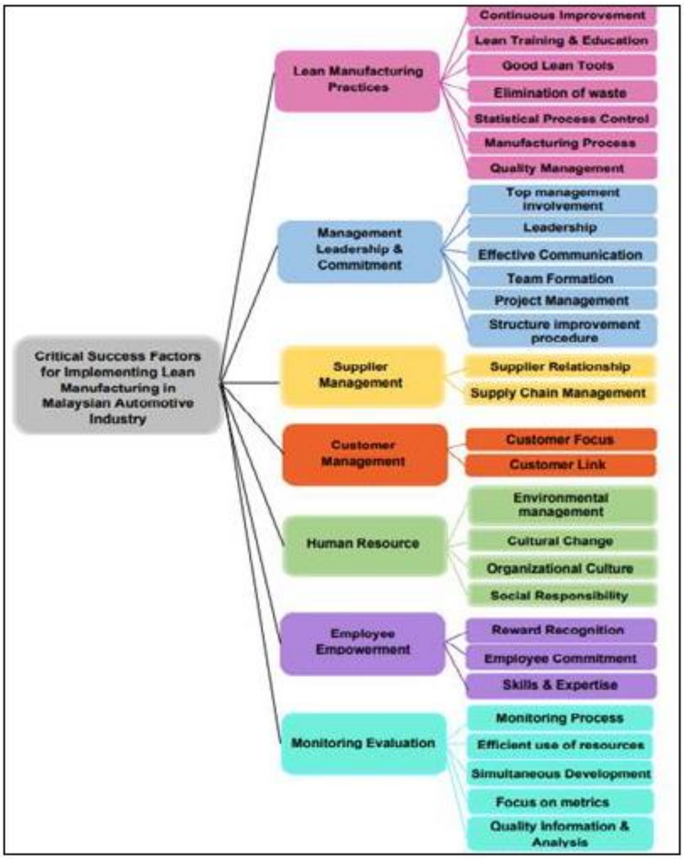

Figure 2.1 Model Critical Success Factor According to Construct

3.0 METHODOLOGY

This chapter will show the overall planning for this study such as the respondent needed to answer the questionnaire, the research instrument used like SPSS software and questionnaire and method for data analysis which are pilot study, full survey, reliability test, EFA and KMO, Bartlett's Test and involve Friedman Test. The data for this study was gathered by email questionnaires sent to experienced personnel, engineers, and senior management in the automotive industry in Malaysia. This study takes a quantitative method, employing a survey to investigate CSF for Lean Manufacturing Implementation in the Malaysian Automotive Industry.

No	Research Objectives	Research Questions	Data Collection	Analysis Method
1.	To identify the Critical Success Factors (CSF) for Implementing Lean Manufacturing in Malaysian Automotive Industry in Johor.	What is the Critical Success Factors (CSF) for Implementing Lean Manufacturing in Malaysian Automotive Industry in Johor?	Qualitative Research strategy through questionnaire	➢ Reliability Cronbach Alpha ➢ KMO & Bartletts Test ➢ Multivariate Analysis
2.	To determine highest ranking of CSF of Malaysian Automotive Industry in Johor through implementation of Lean Manufacturing.	What is the highest ranking of CSF of Malaysian Automotive Industry in Johor through implementation of Lean Manufacturing?		➢ Friedman Test (mean ranking Analysis)
3.	To develop a conceptual model framework of CSF for implementing Lean Manufacturing in Malaysian Automotive Industry in Johor.	What is the suitable conceptual model framework of the CSF for implementing Lean Manufacturing in Malaysian Automotive Industry in Johor?		➢ Reliability Cronbach alpha ➢ KMO & Bartletts Test ➢ Multivariate Analysis ➢ EFA (Exploratory Factor Analysis)

Figure 3.1 Research Instruments and Analysis Method

4.0 RESULT AND DISCUSSION

4.1 List of Factors

Table 4.1 List of Variables Names of Factors

NO	VARIABLES	FACTORS
1	LMP1	The organization is very concern about Lean practices in the workplace.
2	LMP2	The organization provide opportunities for employees and staff for Lean training and education purposes.
3	LMP3	The organization apply good Lean tools in the working area (e.g.: 5S, Kanban, Bottleneck Analysis, etc)
4	LMP4	The organization always stressing about elimination of waste especially in the production area.
5	LMP5	The organization alert with the non-value added (NVA) activities in the company
6	LMP6	The organization able to maximize the productivity of the whole systems using Lean Manufacturing
7	MLC1	Excellence leadership from the management
8	MLC2	Flexible workforce in the working area

9	**MLC3**	Good communication among staff in organization can give effect toward lean practices in the organization
10	**MLC4**	Good commitment and support from the top management and superiors
11	**MLC5**	The organization holds a regular meeting to improve productivity system in the workplace.
12	**CM1**	The customers' needs in this organization are clearly identified.
13	**CM2**	Good results of lean manufacturing implementation in the organization gives guaranteed to the customers
14	**CM21**	The organization always consider delivering customer value added in their product and services.
15	**CM22**	The organization focus on maintaining the profitability and customer satisfaction.
16	**CM23**	The organization always succeed in meeting the customer satisfaction.
17	**SM1**	The organization used Lean management in the supply chain to reduce cost and improve efficiency (ex: just-in-time inventory system)
18	**SM2**	Lean supply chain management are used in the warehouse and freight network
19	**SM3**	Goal of the supplier management succeeded to meet & exceed the buyer's expectations in terms of quality, delivery, and cost in this organization.
20	**HR1**	Information is easily accessible to those who need it
21	**HR2**	Good selective in hiring
22	**HR3**	Strong organizational skills.
23	**HR4**	Strong and effective communication skills with all parties involved.
24	**HR41**	Fair and performance-based compensation.
25	**EE1**	The organization always appreciate their workers with "Employee Reward & Recognition".

26	**EE11**	The organization encourage trust and open communication between superiors and employees.
27	**E2**	The organization always consider and accept the ideas in decision making and goal setting.
28	**E3**	The tools and equipment by employees are always provided for them to work with.
29	**E4**	The organization provide a flexible working policy for the employees.
30	**ME1**	5S sustainment is part organization‘s culture
31	**ME2**	Rejections and Rework affect the production process
32	**ME3**	The organization are using Lean tools for Monitoring Process (ex: Kaizen, SMED, Six Sigma, etc.)
33	**ME4**	Tasks are inspected with acceptable quality specifications in calibrated testing tools and the results well documented.
34	**ME5**	Quality standards are followed and having at most importance to the customer satisfaction
35	**ME6**	The organization are using Lean tools for Production Process Evaluation (ex: PDCA, VSM, OEE, etc.)
36	**ME7**	A daily/weekly preventive maintenance schedule is noticeable.

4.2 Reliability Test

This reliability test was conducted for 133 respondents who answered the questionnaire. There are only 36 questions for 7 constructs. This test is to ensure whether these 36 questions were reliable or not. The general law is to check whether the Cronbach's Alpha or the reliability coefficient is smaller or larger than 0.7. In the value is less than 0.7, at that point a portion of the factor are prescribed to be deleted. However, if the value is more than 0.7 none of the factors could be deleted.

Table 4.2 Cronbach Alpha's for Full Survey

Reliability Statistics

Cronbach's Alpha	N of Items
.991	36

4.3 Non-Response Bias

The non-response bias analysis was conducted to ensure the respondents were not biased when answering the questionnaires. It is because to avoid any risk or potential bias result from the respondents and the result will affected or may differ between other respondents. This non-response bias was analysed by comparing the data of the early and late respondents.

Table 4.3 T-Test

		Mean	N	Std. Deviation	Std. Error Mean
LMP1	Early	4.6923	26	.54913	.10769
	Late	4.7308	26	.60383	.11842
LMP2	Early	4.3462	26	.56159	.11014
	Late	4.5769	26	.64331	.12616
LMP3	Early	4.3462	26	.48516	.09515
	Late	4.5385	26	.50839	.09970
LMP4	Early	4.5385	26	.50839	.09970
	Late	4.6154	26	.49614	.09730
LMP5	Early	4.5000	26	.50990	.10000
	Late	4.6538	26	.48516	.09515
LMP6	Early	4.3846	26	.49614	.09730
	Late	4.6154	26	.49614	.09730
MLC1	Early	4.3846	26	.57110	.11200
	Late	4.6538	26	.56159	.11014
MLC2	Early	4.4615	26	.64689	.12686
	Late	4.4231	26	.70274	.13782
MLC3	Early	4.3462	26	.48516	.09515
	Late	4.6154	26	.49614	.09730
MLC4	Early	4.5000	26	.50990	.10000
	Late	4.4615	26	.50839	.09970
MLC5	Early	4.5385	26	.58177	.11410
	Late	4.5385	26	.58177	.11410
CM1	Early	4.4615	26	.50839	.09970
	Late	4.7692	26	.42967	.08427
CM2	Early	4.3462	26	.48516	.09515
	Late	4.5769	26	.50383	.09881
CM32	Early	4.5769	26	.50383	.09881
	Late	4.4615	26	.50839	.09970
CM41	Early	4.6538	26	.48516	.09515
	Late	4.5000	26	.50990	.10000

CM51	Early	4.3077	26	.47068	.09231
	Late	4.5385	26	.50839	.09970
SM1	Early	4.7692	26	.42967	.08427
	Late	4.5769	26	.64331	.12616
SM2	Early	4.2692	26	.66679	.13077
	Late	4.3846	26	.69725	.13674
SM3	Early	4.2692	26	.45234	.08871
	Late	4.5000	26	.58310	.11435
HR1	Early	4.6154	26	.57110	.11200
	Late	4.6923	26	.54913	.10769
HR2	Early	4.4231	26	.57779	.11331
	Late	4.4231	26	.70274	.13782
HR3	Early	4.2692	26	.53349	.10463
	Late	4.5385	26	.64689	.12686
HR4	Early	4.4615	26	.50839	.09970
	Late	4.5385	26	.50839	.09970
HR54	Early	4.5385	26	.58177	.11410
	Late	4.4615	26	.70602	.13846
EE1	Early	4.5385	26	.64689	.12686
	Late	4.6154	26	.57110	.11200
EE21	Early	4.5000	26	.50990	.10000
	Late	4.3846	26	.63730	.12499
EE2	Early	4.3846	26	.49614	.09730
	Late	4.3846	26	.63730	.12499
EE3	Early	4.2692	26	.53349	.10463
	Late	4.5769	26	.50383	.09881
EE43	Early	4.3077	26	.67937	.13323
	Late	4.5000	26	.64807	.12710
ME1	Early	4.8077	26	.40192	.07882
	Late	4.8462	26	.36795	.07216
ME2	Early	4.5385	26	.50839	.09970
	Late	4.5769	26	.50383	.09881
ME3	Early	4.5000	26	.50990	.10000
	Late	4.5385	26	.50839	.09970
ME5	Early	4.4615	26	.50839	.09970
	Late	4.6154	26	.49614	.09730
ME6	Early	4.3077	26	.54913	.10769
	Late	4.6538	26	.48516	.09515
ME7	Early	4.4615	26	.50839	.09970
	Late	4.6154	26	.49614	.09730

From the tables, the researcher able to obtain no response biased between early and late response. The researcher collects 25 early respondents and 25 late respondents. It follows with the pilot testing requirements which is only 25-50 respondents shall be tested. It has no rule of thumb for this non-response biased but the result from the above table shows a good result from overall 25 early and late respondents.

4.4 KMO & BARLETT'S TEST

Table 4.4 KMO & BARLETT'S TEST

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.951
Bartlett's Test of Sphericity	Approx. Chi-Square	6421.635
	df	630
	Sig.	<.001

The Kaiser-Meyer-Olkin value is 0.951. The KMO values are greater than 0.5, and the data are acceptable for our study. Additionally, a measurement of sample adequacy shows what proportion of the variance in the variables was brought on by underlying factors. Therefore, the use of factor analysis is acceptable, and the value of the Bartlett's test of sphericity, which is 0.00, supports this (less than 0.05).

4.5 EXPLORATORY FACTOR ANALYSIS

Table 4.5 Exploratory Factor Analysis

Rotated Factor Matrix			
	Factors		
	1	2	3
LMP1	.942		
LMP2	.938		
LMP3	.903		
LMP4	.869		
LMP5	.888		
LMP6	.862		
MLC1		.916	
MLC2		.869	
MLC3		.904	
MLC4		.922	
MLC5		.917	
MLC6		.912	
CM1	.940		

CM2	.882		
CM32	.883		
CM41	.930		
CM51	.928		
SM1	.922		
SM2	.887		
SM3	.898		
HR1		.941	
HR2			.894
HR3		.925	
HR4		.938	
HR54		.919	
EE1			.925
EE21			.858
EE2			.899
EE3			.916
EE4			.925
ME1		9.34	
ME2		.871	
ME3	.883		
ME4	.908		
ME5	.915		
ME6	.934		
ME7	.925		
Extraction Method: Principal Axis Factoring.			

There are 3 construct and 36 items. No items were excluded. However, as a side note, some of the items are shown as the additional questions to support the items, and not belonged to the visualized conceptual model – refer figure 2.1. The initial conceptual model has a number of 29 items and supported by 7 additional questions in the survey. Thus, the 29 items are remained still and loaded into 3 construct factors. These 3 constructs factor is compared with the original of 7 constructs from the questionnaire generated.

Exploratory factor analysis shows these are the items that are correct to be placed in one constructed and regrouped again. Based on the shown rotated factor matrix, the first factor is classified as **Quality Performance** which consists of 14 items. The second factor can be classified as **Organization Management.** There are 11 items consist in this factor. Last but not least, the third factor can be classified as **Employee Behaviour** which consists of 4 items.

Table 4.6 The New Model CSF of Lean Manufacturing Implementation

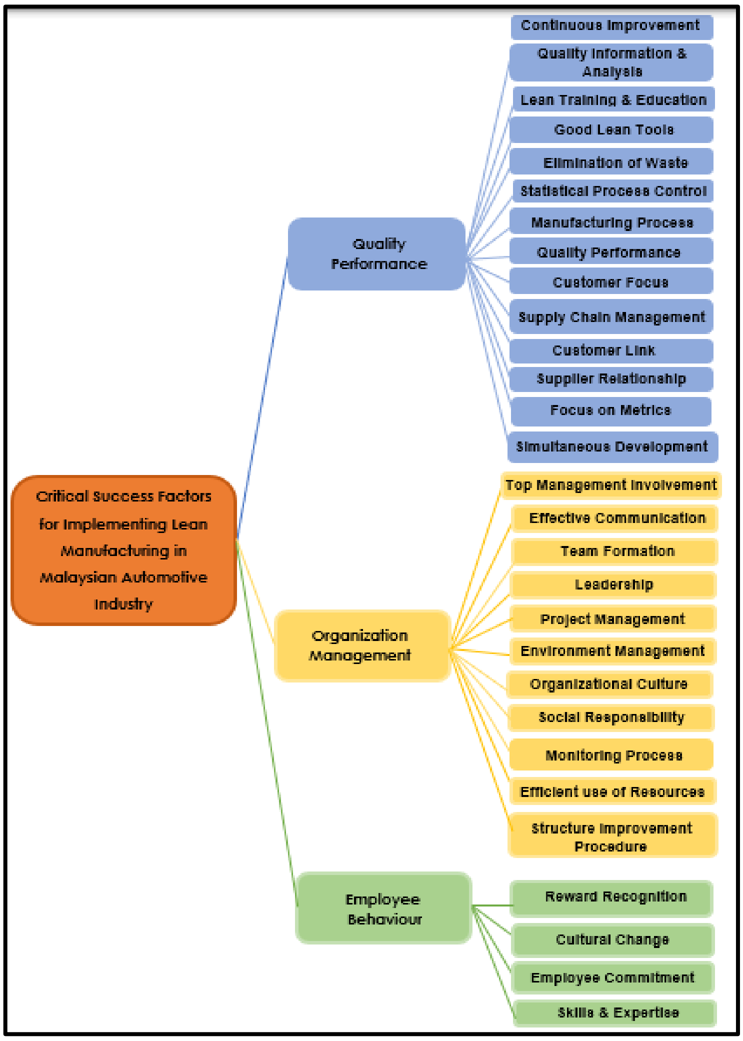

Figure 4.1 New Model of Critical Success Factor of Lean Manufacturing Implementation in Malaysian Automotive Industry

The new model is constructed after the results from the questionnaire was analysed by the researcher. From here, the seven construct has been downgraded into three important constructs and 29 items. The three constructs are Quality Management, Organization Management, and Employee Behaviour.

5.0 CONCLUSION AND RECOMENDATIONS

5.1 Conclusion

A study of Critical Success Factor of Lean Manufacturing Implementation in Malaysian Automotive Industry is a success, and the objectives are achieved concluded by the researcher. Moreover, the recommendation and suggestion are provided in the study for future research purpose. The researcher able to list down factors that are success for the implementation of Lean Manufacturing. Not only that, by developing a conceptual model of CSF in this industry, the company can prioritize the most critical resources for their organization that lead to improved performance and strategy management. Last but not least, the CSF model can also be a guidance to the new industry or organizations who still considered beginners and interested to implement Lean Manufacturing (LM) in their organization.

5.2 Recommendations

There are some recommendations to the future researcher for the better accomplishment. The recommendations are as follow:

1. It is recommended to concentrate this research on a specific industry. It is because the CSF model is focusing on the Automotive Manufacturing & Assembly Plants. Different industries might implement Lean Manufacturing in different attitudes. By applying the appropriate Lean Manufacturing principles and techniques, the problems can thus be clearly identified and solved properly.

2. Interviewing knowledgeable professionals in the field is another approach. The researcher will gain more information from the interview and find it simple to discuss all relevant issues of Lean Manufacturing application that has implemented in their own company. The reason for this is that they have deep knowledge implementing lean and are aware of how and where to apply it to their processes. However, in this research, the researcher did not interview the expert or experience personnel due to the time and access resources limitation.

6.0 ACKNOWLEDGEMENT

First of all, I want to wish grateful to the Almighty for all blessing and my deep appreciation to my supervisor Mr. Amran Daril, for the valuable advice and guidance throughout my final year project and dissertation process. Also, l am very grateful indebted to my parents and million thanks to my lecturers, and my beloved friends for giving me support and encouragement. Not forgetting to thank the University Kuala Lumpur, Malaysian Institute of Industrial Technology administration for their cooperation in providing me valuable information that I needed for completion my project.

7.0 REFERENCES

[1] Abdulmalek, F. A., & Rajgopal, J. (2007). Analyzing the Benefits of Lean Manufacturing and Value Stream Mapping via Simulation: A Process Sector Case Study. *Internaitional Journal_of_Production_Economics,107(1):223.* https://doi.org/http://dx.doi.org/10.1016/j.ijpe.2006.09.009

[2] Bicheno, J., & Holweg, M. (2000). *The Lean Toolbox*. 2nd Ed, Picsie Books. https://www.researchgate.net/publication/309012216_The_Lean_Toolbox_5th_edition_A_handbook_for_lean_transformation

[3] Colette. (1998). A Comprehensive View of Process Engineering. *International Conference on Advanced Information Systems Engineering, 1413/1998,.*

[4] Conti R, Angelis, J, Cooper C, Faragher B, G. C. (2006). The effects of lean production on worker job stress. *International Journal of Operations & Production Management, 26 (9),*

(2.https://www.sciencedirect.com/science/article/pii/S1877705814035309?ref=pdf_download&fr=RR-2&rr=788ecd61f86287c5

[5] Goichoechea, I., & Fenollera, M. (2012). QUALITY MANAGEMENT IN THE AUTOMOTIVE INDUSTRY. *DAAAM INTERNATIONAL SCIENTIFIC BOOK 2012*, *51*,619–632. https://www.daaam.info/Downloads/Pdfs/science_books_pdfs/2012/Sc_Book_2012-051.pdf

[6] Li, S., Ragu-Nathan, & Rao, S. (2005). Development and Validation of a Measurement Instrument for Studying Supply Chain Practices. *Journal of Operations Management*, *23*(6), 618–641. https://doi.org/http://dx.doi.org/10.1016/j.jom.2005.01.002

[7] Liker, J., & Meier, D. (2004). *The Toyota Way Fieldbook 1st Edition* (1st ed.). McGraw Hill. https://www.amazon.com/Toyota-Way-Fieldbook-Jeffrey-Liker/dp/0071448934

[8] McCutcheon, D.M., Meredith, J. . (1993). Conducting case study research in operations management. *T. Journal of Operations Management*, *11 (3), (1*. https://www.sciencedirect.com/science/article/pii/S1877705814035309?ref=pdf_download&fr=RR-2&rr=788ecd61f86287c5

[9] Ohno, T. (1988). *Toyota Production System*. Productivity Press. http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4694/1/Toyota Production System Beyond Large-Scale Production.pdf

[10] Papadopoulou, T., & Ozbayrak, M. (2005). Leanness: Experiences from the Journey to Date. *Journal of Manufacturing Technology Management*, *16*(7), 784–807. https://doi.org/http://dx.doi.org/10.1108/17410380510626196

[11] Pearce, A., & Pons, D. (2013). Implementing Lean Practices: Managing the Transformation Risks. *Journal of Industrial Engineering*. https://doi.org/https://doi.org/10.1155/2013/790291

[12] Rinehart, J., Huxley, C., & Robertson, D. (1997). *Just Another Car Factory?: Lean Production and Its Discontents* (1st Editio). Cornell University Press. https://www.econstor.eu/bitstream/10419/240919/1/Full-text-chapter-Krzywdzinski-Lean-production-in.pdf

[13] Rockart, & J.F. (1982). The Changing Role of the Information Systems Executive: A Critical Success Factors Perspective. *Sloan Management Review*, *24*, *3–13*.

[14] Rockart, & J. (1979). Chief Executives Define Their Own Information Needs. *Harvard Business Review*, 81-92.

[15] Womark, J. P., & Jones, D. T. (1996). *Lean Thinking - Banish Waste and Create Wealth in Your Cooperation*. https://www.academia.edu/34563325/James_P_Womack_Lean_Thinking

[16] Wong, Y. C., Wong, K. Y., & Ali, A. (2009). *A Study on Lean Manufacturing Implementation in the Malaysian Electrical and Electronics Industry*. https://www.researchgate.net/publication/242546617_A_Study_on_Lean_Manufacturing_Implementation_in_the_Malaysian_Electrical_and_Electronics_Industry

[17] Zargun, D., & Ashaab, A. Al. (2014). Critical Success Factors for Lean Manufacturing: A Systematic Literature Review: An International Comparison between Developing and Developed Countries. *Advanced Materials Research*. https://doi.org/http://dx.doi.org/10.4028/www.scientific.net/AMR.845.668