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Research Article

Critical Success Factors for Implementing Lean Manufacturing in Malaysian Automotive Industry

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Abstract: The challenges faced by automotive manufacturers had made them looked into Lean Manufacturing (LM) which was implemented by Toyota Motor a long time ago. In Malaysia, the two main car manufacturers are PROTON and PERODUA; these two manufacturers offer good opportunity to large local companies and Small Medium Enterprises (SMEs) to participate in the automotive component manufacturing industry. The main objective of this study is to explore and investigate the level of perceptions on the importance and extent of practice with respect to 13 Critical Success Factors (CSFs) for LM implementation. To perform this study, a survey instrument that consists of 13 CSFs and 78 items was developed and distributed to local companies. The comparison was carried out on each of these CSFs based on perception, number of years and company size. The statistical analysis using the Kruskal Wallis test had identified four basic critical success factors for both SMEs and large companies with respect to the perception on the importance and extent of practice. Further study probes into the outcomes of the exploration on feasible LM practices.

Keywords: Comparison, CSF, perception, Small and Medium Enterprises (SMEs), survey

INTRODUCTION

Today, Small and Medium Enterprises (SMEs) can be considered as the lifeblood of modern economies because these enterprises are suppliers of goods and services to larger organizations. To survive nationally and internationally, SMEs need to produce high quality products at competitive prices. Consequently, globalization has driven organizations to look at the right management system to improve existing manufacturing systems. According to Rineheart *et al*. (1997), Lean Manufacturing (LM) will be the standard manufacturing mode of the 21st century. The main strength of LM is its ability to reduce manufacturing cost through elimination of wastes and if well implemented, it can guide a company to become a world class organization (Papadopoulu and Ozbayrak, 2005). This approach in eliminating wastes has made a substantial impact on manufacturing companies, resulting in higher performance enhancement and significant improvement in delivery, quality, flexibility and manufacturing cost (Fullerton and Mcwatters, 2001). LM is widely known by researchers and practitioners after Womack *et al*. (1990) published the book entitled "The machine that changed the world". Later, LM became an established field of research. The majority of researchers had concentrated their researches on lean performance, lean indicators and lean implementation (Bhasin and Burcher, 2006; Sanchez and Perez, 2001; Shah and Ward, 2007). Achanga *et al*. (2006) and Farris *et al*. (2009) investigated the importance of critical success factors for effective and successful LM implementation. Up till now, majority of LM researchers focus on large companies, and very little has been published with respect to LM implementation in SMEs (Achanga *et al*., 2006; Sanchez and Perez, 2001; Yang and Yu, 2010). The objective of these studies is to provide a list of CSFs which could assist SMEs to succeed in LM implementation. The two main objectives of this study are to investigate the differences in level of perceptions and practices on Critical Success Factors (CSFs) in large companies and SMEs in automotive component manufacturing industry.

LITERATURE REVIEW

There are many papers published on CSFs with respect to total quality management, Six Sigma and Materials Resource Planning (MRP) (Brun, 2010; Coronado and Antony, 2002; Farris *et al*., 2009; Wong *et al*., 2009; Yusof and Aspinwall, 2000).

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Table 1: Highlighted factors for lean manufacturing implementation in SMEs

Item	1	2	3	4	5	6	7	8
Management leadership and commitment	*	*	*	*	*	*	*	*
Training and education	*	*		*	*	*		*
Employee involvement	*			*	*	*		*
Customer management involvement		*				*		*
Supplier management involvement		*			*			*
Quality management		*		*				*
Effective communication					*		*	*
Organizational culture		*				*		
Empowerment of employees						*	*	
Continuous improvement				*	*			
Human resource management							*	
Effective communication						*		

1: Ferdousi and Ahmed (2009); 2: Kumar and Anthony (2008); 3: Real *et al*. (2007); 4: Achanga *et al*. (2006); 5: Saleheldin (2005); 6: Motwani (2003); 7: Yauch and Steudel (2002); 8: Chang and Lee (1996)

Rokart (1979), a pioneer in CSF, defined CSFs as the "areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization". Meanwhile, Saraph *et al*. (1989) who pioneered the study of CSFs for Total Quality Management (TQM) defined CSFs as those "critical areas of managerial planning and actions that must be practiced in order to achieve effectiveness in a business unit". Deros *et al*. (2006) believed CSFs could act as an agent to initiate successful change. Achanga *et al*. (2006) highlighted that CSFs must be present in order to ensure successful LM implementation. Saleheldin (2009) posited that CSFs should be strived for mission achievement towards new management system implementation. Similarly, Kumar and Antony (2008) concluded that LM implementation may fail if organizations do not practise these CSFs such as top management commitment, training and customer involvement. These managerial activities and practices must be pursued to ensure LM implementation success in the organization (Yusof and Aspinwall, 2000). Based on thoroughly reviewed and recent LM publications, there are 12 CSFs being highlighted and discussed extensively and they are summarized in Table 1. The three major LM factors, such as top management commitment, training and education, and employee involvement have been widely discussed in the existing literature. This study reviews and analyses CSFs, highlighted by previous researchers and practitioners in Total Quality Management (TQM) and LM such as Ferdousi and Ahmed (2009), Saleheldin (2009), Kumar and Antony (2008), Real *et al*. (2007), Abdullah (2006), Achanga *et al.* (2006), Ahrens (2006), Saleheldin (2005), Motwani (2003), Antony *et al*. (2002), Yauch and Steudel (2002), Yusof and Aspinwall (2000) and Chang and Lee (1996). Most of the papers studied CSFs for LM implementation in large companies but not in SMEs. Therefore, the authors strongly believed that there is a need to conduct CSFs studies for LM implementation in SMEs involved in automotive component manufacturing industry.

Malaysian SMEs was defined as companies with number of full time employees between five to 150 employees and annual sales turnover between RM251k to RM25 million (SME Corp., 2010).

METHODOLOGY

The research methodology used was survey questionnaire. The questionnaire was adopted and adapted from survey instruments used by previous researchers, such as Fullerton *et al*. (2003) and Shah and Ward (2007). The CSFs were selected based on comprehensive reviews of related papers in LM and TQM with the notion that both LM and TQM are interrelated with each other. At the early stage, the CSFs gathered comprised of 12 factors and 78 elements. Respondents were asked to rate the level of importance and practice of these CSFs within their companies. In this survey, a 5 point Likert rating scale was used to measure the level of importance, from 1-not important to 5-very important. Meanwhile, for the level of practice, from1-not implemented to 5-highly implemented. This scale was used to measure the extent of implementation of CSFs within the respective companies. As a part of the validation process, the questionnaire was given to ten experts (5 practitioners and 5 academicians) in LM to get their comments with respect to its contents, length, structure and language used. As a summary of their comments, the experts suggested to the authors to reduce the total number of CSFs; meanwhile, each CSF should have at least 6 sub-factors. Reliability and validity tests were conducted on the questionnaire using guidelines provided by Sakakibara *et al*. (1993) and Flynn *et al*. (1994). Reliability is an evaluation of measurement consistency, whereas validity test is to determine the quality of measurement instrument on what was claimed to be measured. Internal consistency was used for analyzing the reliability of each factor. In general, the agreed alpha for good reliability is 0.70; however, alpha 0.60 is still acceptable for exploratory research (Flynn *et al*., 1994). The internal consistency was performed separately on each of the 12 factors using SPSS V.17.

A pilot test was conducted to ensure the constructed questionnaire is reliable and valid. According to Palaniappan (2009), the minimum number of samples for a validity test is 30. Meanwhile, Wong

et al. (2009) gathered feedbacks from 50 respondents in their survey questionnaire's validation process. In the pilot test, the questionnaire was accompanied with a support letter to increase respondents' motivation to answer the questionnaire (Dillsman, 1978). To do this, the questionnaire was sent to 100 respondents' companies where 30 survey questionnaires were completed and returned, giving a response rate of 30%. Later a reliability test was conducted on the questionnaire to measure the respondents' rating consistency. Comments made by the respondents were taken into consideration in enhancing the quality of the questionnaire. The main objective was to improve on the questions, making them easily understood by the respondents. The questions were then checked for their reliability and validity.

RESULTS AND DISCUSSION

Survey results: Initially, 250 questionnaires were distributed by postal and electronic mail to potential respondents. Unfortunately, only 27 completed questionnaires were returned by the respondents, giving a poor response rate of 10.8%. Due to this poor response rate, the authors decided to contact a department of an automotive vendor developer from one of the National Car Manufacturers to garner some support on potential respondents. In March 2011, the authors' application was approved where the authors were given a time slot during a vendor briefing programme and annual quality presentation. On that day, the authors personally distributed the questionnaire to all 157 participants. At the end of both programmes, 70 sets of completed usable questionnaires were collected which gave a response rate of 44.6%. Finally, the total number of completed and returned survey questionnaires rose to 97 sets where this number is adequate for performing the SPSS analysis (Chavez *et al*., 2013).

Respondents' demographic background: Respondents of this survey comprised of Chief Executive Officer (CEO), General Managers (GM), Senior Manager, Production Manager, Quality Assurance/Quality Control (QA/QC) Manager and Production Engineer/Executive. The authors believed that they are the right people to answer the questionnaire. Table 2 shows their respective designations or positions in their respective companies. Referring to Table 2, almost 58% of the respondents are working in the production department (i.e., Production Manager, QA/QC Manager and Production Engineer/Executive). This is expected because LM normally starts and is being practiced at the production line to eliminate wastes such as inventory, motion and quality.

The respondents were categorized according to their place of work such as SMEs and large companies.

Table 2: Respondents' position

Position	Frequency	(%)
CEO/director/GM/senior manager	3	3.1
Production manager	23	23.7
QA/QC manager	13	13.4
Production engineer/executive	20	20.6
Others	38	39.2
Total	97	100.0

Table 3: Type of ownership

Type of ownership	Frequency	(%)
Local	65	67.0
Foreign	9	9.3
Joint venture	23	23.7
Total	97	100

Table 4: Companies' involvement in lean manufacturing

Number of years	Frequency	(%)
Less than 3 years	36	37.1
>3 and <5 years	33	34.0
>5 years	28	28.9
Total	97	100

Table 5: Types of main products

Type of product	Frequency	(%)
Metal	30	30.9
Rubber	29	29.9
Plastics	20	20.6
Electronic	10	10.3
Mechanical	5	5.2
Electrical	5	5.2
Others	18	18.6
Total	97	100

SME was defined based on the number of full time employees and amount of total turnover. To qualify as a SME, a company has to have less than 150 employees and an annual turnover less than RM25 million (SME Corp., 2010). Normally, a company's annual turnover is confidential and not all employees can access this information, therefore, the authors decided to use the number of employees as an indicator for company size. In this study, 35 SMEs and 62 large companies participated in the survey. The percentage of respondents from SMEs was 36% compared to 64% from large companies. The type of ownership of the companies involved in this study is as depicted in Table 3, where the majority (i.e., 67%) of the survey participants are working with Malaysian owned companies. Meanwhile, 23.7% of the respondents' companies are joint venture and the remaining 9.3% are foreign owned.

At present, LM implementation in Malaysia is still considered at an infancy stage. This can be seen in Table 4, where a majority (71.1%) of the companies are involved in LM less than 5 years and only 28.9% are more than 5 years.

Table 5 shows the main products produced by the companies involved in this survey, which comprises of: 30.9% metal parts, 29.9% rubber parts, 20.6% plastic parts, 10.3% electronic parts, 5.2% mechanical parts, 5.2% electrical parts and 18.6% other parts (adhesive,

Table 6: Result of internal consistency analysis

	Critical Success Factors (CSFs)	No. of item	Perception (α)	Practice (α)
F1	Management commitment and leadership	8	0.868	0.851
F2	Empowerment of employees	7	0.918	0.905
F3	Employee involvement	6	0.930	0.925
F4	Training and education	6	0.898	0.883
F5	Effective communication	6	0.936	0.918
F6	Organizational culture	7	0.940	0.929
F7	Feasible lean practices	7	0.874	0.867
F8	Human resource management	6	0.951	0.926
F9	Continual evaluation and measurement	6	0.924	0.901
F10	Quality management	6	0.940	0.908
F11	Continuous improvement	6	0.876	0.888
F12	External management	8	0.876	0.801
	Total	78		

Table 7: Results of factor analysis

	CSF	Eigen value	Variance explained (%)	Items for deletion	Item loading range	KMO
F1	Management commitment and leadership	3.911	55.877	Item 8	0.634~0.810	0.866
F2	Empowerment of employee	4.491	64.157	None	0.713~0.855	0.901
F3	Employee involvement	4.416	73.601	None	0.777~0.910	0.882
F4	Training and education	3.820	63.664	None	0.657~0.844	0.844
F5	Effective communication	4.272	71.195	None	0.781~0.903	0.877
F6	Organizational culture	4.917	70.237	None	0.803~0.860	0.904
F7	Feasible lean practices	3.649	60.818	Item 7	0.678~0.860	0.845
F8	Human resource management	4.399	73.321	None	0.809~0.903	0.884
F9	Continual evaluation measurement	4.037	67.284	None	0.724~0.881	0.896
F10	Quality management	4.128	68.808	None	0.745~0.881	0.859
F11	Continuous improvement	3.874	64.568	None	0.685~0.901	0.883
F12	Customer management	2.549	63.715	None	0.739~0.849	0.754
F13	Supplier management	2.054	51.339	None	0.628~0.765	0.729

carpet, lubricant, etc.) for the automotive component industry.

Reliability and validity tests: Reliability and validity tests are very important prior to conducting any analysis. Internal consistency was chosen because it is widely used by researchers (Sakakibara *et al*., 1993). Referring to Table 6, all factors for both perception and practice have α values higher than 0.7, which can be interpreted as all the items in the questionnaire measure a construct hence reliable for analysis (Flynn *et al*., 1994). These results show that the respondents had rated these factors consistently.

Therefore, the authors believed that CSFs selected in this study have high content validity based on the information gathered on extensive literature review of past literature, experts validation and pilot run. In addition, the survey instrument was tested for construct validity. This analysis was carried out to ensure the rating given by respondents was accurate as it was designed to measure. The construct validity of each CSF was analyzed using SPSS Dimension reduction (Factor analysis) method. The authors used two approaches to confirm whether the factor will be maintained or deleted based on item loading >0.4 and Eigenvalue >1. Having done that, the internal consistency was recalculated to factors where element or item was removed.

This study utilized the Kaiser Meyer Olkin (KMO) index on the appropriateness of factorability data. The minimum KMO index for a good factor analysis is at least 0.6 (Tabachnick and Fidell, 2001). All KMO index for 12 factors were above 0.6, thus the data is suitable for factor analysis as shown in Table 7. The first run on factor analysis indicated that nine factors were uni-factorial and three factors (F1, F7 and F12) were bi-factorial. Uni-factorial means that a single factor is extracted for each test. Further analyses were carried out on F1, F7 and F12 by analyzing item correlation coefficient. The item correlation coefficient for F1.8 (variable no. 8 for F1) with F1.2, F1.3 and F1.4 was to be found less than 0.3. This value is considered a poor correlation and should be removed from the system (Tabachnick and Fidell, 2001). Then, the second run factor analysis for F1 demonstrated uni-factorial after F1.8 is removed. Similarly, F7 was also checked for item correlation coefficient and it was discovered that F7.7 has a correlation coefficient which was less than 0.3. Therefore, to ensure that the instrument has high construct validity, item F7.7 was also removed from the analysis. Then the second run factor analysis was carried out on this factor and finally it produced uni-factorial.

The third factor is F12 (external management involvement) is also bi-factorial. There were three variables in this factor with item correlation coefficients lower than 0.3. This finding shows that the correlation between variables on supplier and customer management is very weak. Due to that reason, the authors used the Oblimin rotation, which determined

Table 8: Mean scores on the importance and extent of practice of CSF

Factor	Description	Mean (importance)	Rank (importance)	Mean (practice)	Rank (practice)	Diff
F1	Management commitment and leadership	4.41	3	3.79	2	0.62
F2	Empowerment of employee	4.18	11	3.40	12	0.78
F3	Employee involvement	4.22	9	3.51	9	0.71
F4	Training and education	4.33	5	3.63	6	0.70
F5	Effective communication	4.30	6	3.66	5	0.64
F6	Organizational culture	4.23	8	3.48	10	0.75
F7	Feasible lean practices	4.14	13	3.54	8	0.60
F8	Human resource management	4.14	12	3.40	13	0.74
F9	Continual evaluation measurement	4.30	7	3.56	7	0.74
F10	Quality management	4.46	1	3.79	1	0.67
F11	Continuous improvement	4.42	2	3.73	3	0.69
F12 (N)	Customer management	4.41	4	3.73	4	0.68
F13 (N)	Supplier management	4.18	10	3.42	11	0.76

(N) New factor after PCA analysis

how strongly inter-correlated the factors actually are. It can clearly be seen that this factor has two factors. The first factor comprises of items F12.1, F12.2, F12.3 and F12.4, which are related to customer involvement. Meanwhile, the second factor comprises of items F12.5, F12.6, F12.7 and F12.8 that are related to supplier involvement. Therefore, the authors decided to split this factor into two factors, namely the customer involvement (F12) and supplier involvement (F13). The second reliability tests were carried out and the values for these two new factors are 0.870 and 0.725.

Overall, thirteen factors were studied in this research. Analysis shows that all the thirteen factors are uni-factorial using construct validity (Flynn *et al*., 1994; Pallant, 2007). Having conducted the Principle Component Analysis (PCA) analysis, the research instrument was validated for construct validity.

Comparison on perception of importance and extent of practice for each CSF: The overall mean value for each CSF was calculated to investigate the difference between perception of the importance and extent of practice in the automotive component industry. As shown in Table 8, the three highest CSFs mean values on perception of the importance for implementing LM are: management commitment and leadership (F1) at 4.41, quality management (F10) at 4.46, and continuous improvement (F11) at 4.42, where respondents rated these CFSs as "very important". However, the values for extent of the practice of these three CSFs are: F1 at 3.73; F10 at 3.79 and F11 at 3.73, which denote that they are "moderately practiced".

On the other hand, the three least important factors for the perceived value are: feasible lean practices, human resource, and empowerment of employee with mean values of 4.14, 4.14 and 4.18 respectively. Although, the ranking of these factors were considered least important, they are in the range of "important" to "very important". In terms of extent of practice, the three least practiced factors are human resource management, empowerment of employees and supplier management with mean values of 3.40, 3.40 and 3.42 respectively.

The difference in terms of value between perception of the importance and extent of practiced values ranges from 0.60 to 0.78. This shows that the respondent agreed to the importance of each of CSFs but unable to transform the importance of CSF into practice. The findings of this survey on CSF perceptions and actual practice are in line with findings on total quality management and benchmarking studies carried out on SMEs (Deros *et al*., 2006; Zadry and Yusof, 2006). One of the reasons for the difference in values might be due to the limitation on making decisions. All decision makings are made and finalized by top management. Principally, the two managing approaches for LM in the organization are top down and bottom up (Chang and Lee, 1996). Top management and employees should have the same objectives towards achieving the vision and mission of the companies. Table 8 shows the overall results of respondents' perception of the importance and actual practice ranking values of CSFs are almost similar in all companies. To ensure success, new LM companies are strongly suggested to implement three CSFs: management commitment and leadership, quality management and continuous improvement. Similarly these factors also seem to be in agreement with the findings of other researchers (Kumar and Anthony, 2008; Motwani, 2003; Rose *et al*., 2013).

Comparison on extent of CSFs practice with respect to number of years LM implementation: The CSFs were analyzed based on the number of years where LM is implemented at their companies. As seen in Table 9, the mean value for each of CSF does not vary much amongst three categories of implementation period. The first three CSFs are highly implemented by the beginners (less than 3 years); they are: F12 (customer management), F2 (management commitment and leadership), and quality management (F10). These factors are very important at the early stage; for example, top management must approve every decision

Table 9: The means of extent of CSF practice based on the number of years of LM implementation (n = 97)

		<3 years		3-5 years		>5 years	
	CSF	Mean	Rank	Mean	Rank	Mean	Rank
F1	Management commitment and leadership	3.671	2	3.883	1	3.837	3
F2	Empowerment of employee	3.516	7	3.654	8	3.515	13
F3	Employee involvement	3.324	11	3.571	11	3.696	6
F4	Training and education	3.569	5	3.662	6	3.696	7
F5	Effective communication	3.565	6	3.692	4	3.756	5
F6	Organizational culture	3.250	12	3.646	9	3.595	11
F7	Feasible lean practices	3.458	8	3.596	10	3.589	12
F8	Human resource management	3.111	13	3.505	12	3.661	9
F9	Continual evaluation measurement	3.398	9	3.662	7	3.649	10
F10	Quality management	3.611	3	3.859	2	3.946	1
F11	Continuous improvement	3.569	4	3.788	3	3.863	2
F12	Customer management	3.736	1	3.682	5	3.795	4
F13	Supplier management	3.396	10	3.242	13	3.670	8

Table 10: Means extent of the practice of CSFs based on company size

		SME (n = 35)		Large (n = 62)	
Factor	Description	Mean	Rank	Mean	Rank
F1	Management commitment and leadership	3.718	1	3.832	2
F2	Empowerment of employee	3.567	7	3.560	8
F3	Employee involvement	3.457	10	3.548	9
F4	Training and education	3.624	5	3.645	6
F5	Effective communication	3.686	2	3.650	5
F6	Organizational culture	3.429	11	3.516	11
F7	Feasible lean practices	3.557	8	3.535	10
F8	Human resource management	3.257	13	3.487	12
F9	Continual evaluation measurement	3.519	9	3.583	7
F10	Quality management	3.681	3	3.855	1
F11	Continuous improvement	3.595	6	3.804	3
F12	Customer management	3.643	4	3.786	4
F13	Supplier management	3.393	12	3.440	13

SME: < than 150 employees; Large: > than 150 employees

made with respect to LM implementation. On the other hand, these companies should also get accurate information on customer order quantities for better planning in their production line. In order to secure long term business relationship with customers, these companies have to prove that the quality of products produced is always at par or better compared to other established companies. Companies that have implemented LM more than 3 years are practicing more on three factors such as quality management (F10), continuous improvement (F11) and management commitment and leadership (F1). The mean value for quality management (F10) is 3.946, continuous improvement (F11) is 3.863 and management commitment and leadership (F1) is 3.837, respectively. The categories of number of years in LM implementation did not influence much the extent of CSF implementation. This shows that every company, no matter old or new, were struggling all the time in this system as to improve the system or process. Similarly, Ghosh (2013) discovered that in India, age did not appear to be a major contribution factor for LM implementation.

Overall, Table 9 shows the top four CSFs in LM implementation ranked by respondents and they are: management commitment and leadership (F1), quality management (F10), continuous improvement (F11) and customer management (F12). These four factors seem to be considered as prime factors for LM implementation and should be concentrated and practiced in the organization (Yasin *et al*., 2004).

Comparison on the extent of CFSs practice based on company size: In order to find out the differences between SMEs and large companies on the extent of CSFs practice, the authors segregated the mean values based on company size as tabulated in Table 10.

Mean values on the extent of the practice of CSFs in SMEs and large companies were almost similar. The differences in value were between ±0.007~0.23. The two factors highly practiced by SMEs and large companies are: management commitment and leadership (F1) and quality management (F10). These 2 factors were considered nut and shell in LM implementation. The commitment of top management is really needed in all stages including updating new changes in policy upon LM implementation such as rewards, incentives and reshuffling of staff if necessary. This CSF is also essential in both large companies and SMEs to motivate employees on implementing LM in their workstations. The SMEs rated effective communication (F5) as the second most critical factor

Table 11: Mean score and rank for CSFs practice in SMEs

		<3 years (n = 18)		3-5 years (n = 11)		>5 years (N = 3)		
	CSF	Mean	Rank	Mean	Rank	Mean	Rank	p-value
F1	Management commitment and leadership	3.612	3	3.987	1	3.476	12	0.055
F2	Empowerment of employee	3.456	7	3.842	3	3.333	13	0.067
F3	Employee involvement	3.357	10	3.606	9	3.611	10	0.643
F4	Training and education	3.500	5	3.712	7	4.167	2	0.201
F5	Effective communication	3.627	2	3.833	4	3.556	11	0.474
F6	Organizational culture	3.286	12	3.606	10	3.778	8	0.071
F7	Feasible lean practices	3.381	9	3.742	6	4.111	3	0.063
F8	Human resource management	3.143	13	3.258	12	4.056	4	0.242
F9	Continual evaluation measurement	3.333	11	3.803	5	3.778	9	0.161
F10	Quality management	3.556	4	3.848	2	3.944	7	0.475
F11	Continuous improvement	3.468	6	3.667	8	4.222	1	0.130
F12	Customer management	3.690	1	3.454	11	4.000	5	0.468
F13	Supplier management	3.440	8	3.136	13	4.000	6	0.106

due to its simple structure and less bureaucracy, compared to large companies which rated it as the fifth most critical factor. It is believed that the effective communication could influence the success of LM implementation (Jayaraman and Kee, 2012). Thus, the organization has the chance to disseminate LM progress throughout the organization. This allows the respective departments or employees to plan and take immediate action on any outstanding matters (Worley and Doolen, 2006). Continuous monitoring and quick feedback from top management could alleviate employees' spirit to participate in LM programme. Whereas, the large companies and SMEs agreed organizational culture (F6), human resource management (F8) and supplier management (F13) as the three least implemented factors. It shows the respondents were more concentrated on the CSFs which are related to production assembly line compared to factors which influence the workers indirectly. This can be seen through the highest mean score on management commitment and leadership (F1) for SME and quality management (F10) for large companies. As an example, the top management in SME could make an immediate decision on skill enhancement by allocating budget for training. Similar to this, large companies highlighted on quality management which is known as a road to organizational excellence and satisfying customer needs (Heizer and Render, 2006).

Comparison between the extend of CSFs practice based on company size and the number of years LM implementation: The data were segregated into two categories; SMEs and large companies together with the numbers of years they have implement LM. Referring to Table 11, the extents of CSFs practice for both SMEs and large companies were similar with less than 5 years of experience in implementing LM. However, the extent of the CSFs practice in SMEs and large companies with more than 5 years was slightly different. The reasons might be due to the small number of respondents in this category and they were considered as matured in LM as reflected to well establish CSFs with respect to management commitment and leadership, empowerment employees and effective communication. This result is in-line with previous findings by Chang and Lee (1996) and Ravikumar *et al*. (2014), where top management commitment is concerned. In addition, this study discovered that companies with more than 5 years of experience in LM had highly implemented CSFs such as training and education, feasible lean practices, human resource management, continuous improvement, customer management and supplier management. The Kruskal Wallis test was used to analyze the differences statistically between the SMEs based on number of years of implementation. None of the p values showed significant difference amongst them.

As shown in Table 12, with respect to the number of years of LM implementation, the extent of CSFs practice among the three categories of large companies was similar. The top five CSFs were management commitment and leadership, quality management, continuous improvement, customer management, training and education, organization culture and effective communication. The authors believed that the benefits of LM will not be gained much if the organization fails to support any one of these factors. Therefore, systematic planning and strong effort in these CSFs could ensure success of LM implementation (Motwani, 2003). Finally, Kruskal Wallis was applied as to evaluate the differences in respondents' perception of importance. The Kruskal Wallis is a one way analysis of variance.

This test was used to analyze the significant differences between three categories which are less than 3 years, between 3 to 5 years and more than 5 years in LM implementation. None of the factors showed any significant difference, $p>0.01$. The survey findings suggested that both new and older companies i.e., SMEs and large companies had adopted almost similar CSFs in LM implementation. This indicates all suggested CSFs were very important and it is strongly encouraged for all companies to consider these CSFs in their implementation. Additionally, the top three CSFs

Table 12: Means and rank for CSFs practice of LM large companies

		<3 years (n = 18)		3-5 years (n = 22)		>5 years (N = 25)		
	CSF	Mean	Rank	Mean	Rank	Mean	Rank	p value
F1	Management commitment and leadership	3.752	2	3.831	3	3.880	2	0.787
F2	Empowerment of employee	3.600	6	3.558	10	3.537	12	0.866
F3	Employee involvement	3.278	11	3.553	11	3.707	6	0.167
F4	Training and education	3.667	5	3.636	6	3.640	7	0.986
F5	Effective communication	3.478	9	3.621	8	3.780	4	0.434
F6	Organizational culture	3.200	12	3.667	5	3.573	11	0.148
F7	Feasible lean practices	3.567	7	3.523	12	3.527	13	0.999
F8	Human resource management	3.067	13	3.628	7	3.613	10	0.054
F9	Continual evaluation measurement	3.489	8	3.591	9	3.633	8	0.547
F10	Quality management	3.689	4	3.864	1	3.965	1	0.326
F11	Continuous improvement	3.711	3	3.848	2	3.820	3	0.558
F12	Customer management	3.800	1	3.796	4	3.770	5	0.960
F13	Supplier management	3.333	10	3.300	13	3.630	9	0.109

in this analysis were management commitment and leadership (F1), quality management (F10) and continuous improvement (F11). This shows that the automotive industry has put an emphasis on these areas which indicates that these three CSFs are the most influential factors in implementing CSF. Therefore, any new company that engages the LM system must give serious attention on these CSFs, if not the company might fail.

CONCLUSION

This paper presents the results of an analysis on CSFs for LM implementation in the Malaysian automotive component industry. Initially, the authors considered 12 CSFs with 78 elements to be included in the survey questionnaire. The content validity of the constructed questionnaire was assessed thoroughly by 10 LM experts as to ensure that the content is comprehensive measures of the LM. The reliability and construct validity have proven that the questionnaire is a valid instrument to investigate LM implementation CSFs. The mean values for internal consistency (α) of this instrument were in the range of 0.868-0.951 for perception of importance, whereas for the extent of practice, the mean values were between 0.801-0.929. In addition, uni-factorial analysis was carried out on the survey questionnaire to ensure that it is measuring what it is supposed to measure. Finally, the initial proposed 12 CSFs was enhanced to 13 CSFs because of the external management (F12) was separated into two factors which are the customer management and supplier management.

There are three types of investigation performed in this study:

- A comparison between the level of importance and extent of practice
- A comparison between number of the years LM implementation
- A comparison between SMEs and large companies

The perceived value on the level of perception of the importance and extent of CSF practice mean values were similar as shown in Table 8. These four CSFs that are the management commitment and leadership (F1), quality management (F10), continuous improvement (F11) and customer management (F12) had ranked these factors to be in the first top four of CSFs both with respect to level perception of the importance and extent of the practice. This survey finding is in-line with the CSFs identified by previous researchers in LM implementation such as Achanga *et al*. (2006), Kumar and Antony (2008), Saleheldin (2005) and Motwani (2003). Referring to Table 9; these CSFs are highly practiced by all LM companies. Based on company size as shown in Table 11 and 12, all CSFs were ranked similarly for perception of importance and extent of the CSF practice except for two CSFs, namely effective communication and continuous improvement.

These analyses give us some clues on the factors that must be fully implemented and practiced in order to be successful in LM implementation. These four factors comprise of the following: management commitment and leadership; quality management; continuous improvement; and customer management. This survey finding does not conclude other factors as not important but it suggests that more attention and practice should be given to these four basic factors. In reality, it is more difficult for SMEs to control customer management factor compared to large companies. Therefore, the authors suggest that SMEs should focus on internal CSFs factors compared to external CSFs such as supplier and customer management (Finch, 1986; Lee, 2004). It is believed that the SMEs lack the power to influence large companies whether it is a supplier or customer.

The uniqueness of this study is it is able to provide some guidelines for new manufacturing companies especially to SMEs to explore the list of CSFs that should be focused and implemented. The authors believed that the right LM implementation would be fruitful to the organization. However, as the sample size for this study was not large enough, generalizations from this study to the population need to be made with caution.

Although, the survey was completed as planned, the authors also faced a problem such as data collection

due to the fact that most of the companies need to be approached in person rather than by mail. Therefore, the authors had arranged for another alternative that is contacting the car manufacturers for help on data collection. The research on LM implementation will not stop here, but will be extended to the impact of LM practices and tools implementation on CSFs including the organizations' performance.

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