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Critical Success Factors for Soft TQM and Lean Manufacturing Linkage

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Abstract

Implementation of Total Quality Management (TQM) and Lean Manufacturing (LM) is a common goal for manufacturers to be leaner. While many studies have investigated TQM and LM separately, the present paper explores the Critical Success Factors (CSF) for these practices together in one model focusing on the soft dimension of TQM. A structured closed questionnaire was distributed to operations managers in Malaysian industries. A 5-point Likert scale was used in designing the survey questionnaire. One hundred and two responses were collected in this preliminary study. Results obtained through Principal Component Analysis (PCA) showed that both latent contracts are reliable. Both KMO and Bartlett's test were measured to ensure the adequacy of the practices. Three CSF (3) were extracted for Soft TQM aspects while Seven (7) factors were extracted for LM practices. Results obtained from PCA indicated that Malaysian managers are involved with LM wastes, Kaizen, Just in Time, continuous flow, TPM, Workforce Management, standardized work practices, strategic planning and human aspects. The novelty of the present study stems from the realization of TQM and LM aspects that determine the priorities of Malaysian managers in manufacturing environment by providing guidelines about the most important factors to adopt.

Keywords: *Soft TQM, Lean, Success, Factor, Questionnaire.*

1. Introduction

Both LM and TQM have received much attention from practitioners and researchers in developing and developed countries. Researchers [16] argued that Operations Management (OM) practices such as supply chain, TQM, and LM are applied separately inside enterprises and there is possibility for the integration among these practices that can optimize processes. Although there are many studies conducted on these practices, still, there is a number of questions that remain unclear regarding the applicability of these initiatives [8].

TQM is a vital management tool in ensuring companies can be successful in the continuously growing competition in the global market [9]. Scholars [67] have integrated the Leadership practices in terms of TQM and LM based on the adaptation from several world class awards companies, models and system. Nowadays, Muda (waste) become an important concept for Toyota Production System (TPS). Thus, LM wastes are considered as the DNA for TPS. However, LM is aligned with TQM environment for continuous improvement. Furthermore, more scholars suggested TQM could be categorized into two distinct groups, namely soft TQM and hard TQM ([60]; [33]). Hard TQM tends to use more practical, numeric, and systematic quality-control tools; soft TQM focuses on long-term natures and is more humanistic, it is the human side and people-related TQM [76].

Researchers [6], in their study, argued that there is too much Muda in USA manufacturing system which can be classified as: Muda of workers, Muda of over production, Muda of inventories and excess processing, Muda of defects, Muda of waiting, Muda of movements of materials around factory and Muda of facility. There is paucity in studies that address the impact of LM on the sustainable performance [74]. Both TQM and LM have various ideas and views, and scholars are questioning if they are the same or not? [7]. Different papers reported that TQM and LM can bring more benefits to a company but there is still a lack in case studies on companies that have implemented both initiatives [61].

Limited research has been conducted in the critical elements of LM. According to [56], TQM has been practiced in diverse industries from manufacturing to services. In addition, [10] concluded that issues and common points regarding TQM and LM are not clear. Others argued that TQM considered as tools and techniques of LM [39]. Both are covered in different divisions. For instance, the effect of TQM on employee

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satisfaction and loyalty in government [17], LM tools effectiveness in government [57], change management for adoption of lean principles in distribution centers [41], Integrate Lean, Six Sigma and Logistics into a consistent process [35], Effect of Lean Thinking on functioning of Emergency Departments [38], Development of a lean system for improvement in the healthcare organizations [21]. Authors in the present paper investigate the linkages among these two philosophies to understand in depth the most relevant Critical Success Factors (CSF) for both TQM and LM. Thus, the objective of the present paper is to propose a model to show the linkages between Soft TQM and LM practices and conducting an empirical investigation through the preliminary study in Malaysian industries.

1.1. Objectives of the Study

The present paper aims to explore and identify the success factors for both LM and Soft TQM practices. Further it aims to identify these practices as it depicted from numerous industrial sectors in Malaysian environment. Besides, using modern techniques form statistical package using different practices refer to data reduction through principal component analysis is another aim in the present paper.

The remainder of the present paper is structured as follows: the next section is for reviewing the literature of TQM and LM. This is followed by proposing the model and depicting the methodology and designing the structured questionnaire. Finally, the paper introduces the techniques employed from SPSS to estimate the reliability and extract the necessary factors. Conclusions, limitation and future directions end the work in the present study.

2. Literature Review

In the present paper, literature review comprises different sections in order to understand the linkages among soft TQM and LM practices.

2.1. Total Quality Management (TQM)

TQM is an extended version of the classical production process involving the entire organization and all its functional areas [4]. Researchers [24] define TQM as a management philosophy which aims to contribute continuous improvement in the organization with the participation of all employees to achieve customer satisfaction by producing better, cheaper, faster and safer than competitors. Generally, TQM is classified into soft and hard TQM. Different researchers utilized different factors for each aspect. Thus, plenty of definitions for TQM appeared in the literature. TQM means that quality involves everyone and all activities in the company. Quality means conformance to specifications (meeting customer requirements). Management means that quality can and must be managed [48]. TQM is most commonly seen as a set of dimensions, e.g., leadership, people management, customer focus, supplier management, planning, process management and continuous improvement [1]. According to [48], TQM comprises some primary activities: Business System Planning (BSP), Quality Function Deployment (QFD), Critical Success Factors (CSF) and Balanced Scorecard (BSC).In addition to manufacturing sector, [5] studied the impact of TQM and operational flexibility on hospitals performance.

In the present study the soft dimensions of TQM is taken into consideration upon proposing the conceptual model for several reasons; (1) to be consistent with the conclusions of [51] that the majority of studies agree that soft TQM elements have a crucial role in TQM implementation, (2) ISO 9000 which is a driver to TQM implementation, comprised some elements related to soft TQM, such as management responsibility, customer focus, and (3) Soft TQM aspects have a leading role in TQM implementation and deriving benefits [55], (4) the human factor is a fundamentally important aspect of the implementation of TQM in organizations, (5) quality improvement is influenced mainly by soft TQM elements (however, there is no uniform definition for soft TQM today), and (6) because some scholars suggest that TQM failure is due to deficiencies in soft TQM elements [76]. This justifies why the prsent paper focuses on the soft aspects of TQM.

2.1.1. Soft TQM (STQM)

Although some scholars have begun to discuss the significance of soft TQM, there is little agreement as to its primary construct and statement [76]. According to [76], the constructs of soft TQM are variable by different scholars' practices. Several researchers have suggested different soft and hard factors for TQM. Hard factors are related to the techniques and tools, such as statistical process control and problem solving methods while the soft TQM refer to the "management" part of the TQM which involves people, culture and improvement [25]. They proposed a framework which is comprised of ten different factors for soft TQM. In their study, [3] investigated the linkages among the two dimensions of TQM, namely soft and hard. Researchers [76] consolidated the elements of soft TQM into the following: management leadership, employee fulfillment, employee involvement, training and education, strategic quality policy, and customer focus. Researchers [71] classified the management tools and techniques as hard aspects of TQM and management concepts and principles as the soft side of TQM.

2.2. Lean Manufacturing (LM)

Shah *et al*. [62] argued that LM is clustered into three categories, namely (1) philosophy, (2) practices, and (3) principles. On the other hand, [22] argued that these practices and principles must be designated in an order, such as moving from TQM towards LM. Moreover, [2] argues that the use of the tool and technique for LM is not enough, and has found that companies faced difficulties in implementing LM and could not receive the full benefits because they focus in the lean tools and techniques only (hard lean and do not focus on the human side (people) which is a soft lean. According to Shah and Ward [63], the definition of LM highlights mechanisms needed to achieve the central objective of waste elimination. In other words, LM is production of goods using less of everything. LM can be defined as "an integrated socio-technical system

whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability". Its focus on the reduction of waste improves the customer value.

The goals of using LM in companies are to generate less waste, less human effort, less manufacturing space, less investment in tools and less engineering to develop a new product [7]. Lean thinking or lean production is the same as TPS [18]. Since 1996, the term lean thinking has become as famous as lean production especially in Western industry. Lean has many tools and principles. Previous studies considered LM in different perspectives. For instance, [34] measured LM using one (1) dimension, [66] used six (6) dimensions for LM, [63] adopted ten (10) dimensions, [52] utilized five (5) dimensions, and [43] utilized eleven (11) different LM tools.

2.3. Total Quality Management and Lean Manufacturing Linkage

The present paper is vital because it discusses and assesses the effects of Soft TQM and LM critical success factors (tools and techniques) together in the Malaysian industries'. Researchers discussed that TQM, which comprises hard aspects including the different tools and techniques, is designed to implement LM principles [72]. In general, both TQM and LM have similar goals which are waste reduction, improving performance and the continuous improvement [70]. Moreover, researchers [10] concluded that LM journey is deeper and more widespread as compared to TQM Journey. Wilson [73] argued that if TQM is carefully implemented alongside a kaizen event, it leads to customer satisfaction and that it is considered among the key tools that are often used to facilitate the implementation of the kaizen process which is an important factor for LM. These practices are considered as the most popular initiatives adopted by manufacturers [42]. Researchers [46] concluded that there is a lack of literature studying the simultaneous impact of lean production and TQM on operational performance. [59] explained the fundamental concept of TQM and LM as "if waste can be eliminated, then the profit will go up by the same quantum for an organization". The study conducted by [7] revealed that TQM and LM have much in common. An Integrated TQM with LM is a system which comprises their principles. This system focuses in achieving total customer satisfaction by removing eight wastes available in any process in an organization [66]. According to [32], both tools on lean thinking and TQM have one thing in common, which is the continuous improvement to deliver superior value to the customers. [59] stated that there is no doubt that Kaizen (which is an LM tool) is part of TQM. Furthermore, he concluded that LM comprises many good concepts; all of them are principles/ strategies of TQM. However, TQM is the superset encompassing LM. According to [54], LM philosophy advocates TQM as an approach aimed at reducing manufacturing process variance. They found that JIT and TQM have a direct and positive effect on operational performance. These bundles confirm their roles as the pillars and cornerstones of LM.

3. A Proposed Conceptual Model

To understand the relationships among the practices, the conceptual model is developed. The present paper is based on the proposed model which comprises two multidimensional latent constructs. Figure 1 depicts a path diagram and illustrates cause- effect relationships for the study model. Its causal structure comes from the extensive literature review of the published material. It considers the impact of different factors for TQM on LM dimensions as postulated from the literature review. It is understood that an integrated TQM with LM is a system which comprises TQM and LM principles. Figure 1 shows the schematic presentation of the proposed model. Structural equation modeling techniques are necessary to understand the linkage among soft TQM and LM tools and techniques which is among the future agenda of the present paper. According to [15], TQM implementation is an initial step before implementation of LM. [53] argued that if enterprises have to build a good quality management system, it is necessary to integrate TQM with other similar concepts such as LM.

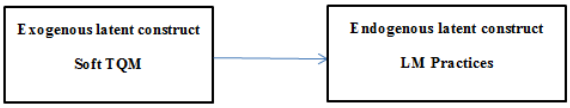

Figure1. Proposed model. Adapted from [15]

4. Methodology

4.1. Design Approach

The design of the present paper is based on a quantitative approach. A structured questionnaire is designed in order to empirically validate the proposed model. The questionnaire consists of two sections related to TQM and LM aspects. All items used are based on 5 points Likert scale. A closed structured questionnaire, as a tool for data collection, was utilized by different researchers including [14], [12], [52], and [76]. It was sent through email to different scholars and academics to modify and revise the items. As a result, the items of the questionnaire were modified. It focused on the measured manufacturing sectors in Malaysia since the manufacturing sector is considered as the backbone of the developing industry [26]. Two directories were followed in order to cluster the certificated industries, namely Federation of Malaysian Manufacturers [30] and through SIRIM website http://www.malaysiancertified.com.my/. Authors critically reviewed these directories until a final list of the certified industries was obtained. The classification of the certified companies in this sector was grouped into twenty four categories which consist of the different manufacturing sectors, indicated in Table 1. A stratified random sample was selected from this list. One hundred and two responses were finally obtained from the respondents' managers and considered an acceptable to run EFA for data reduction.

Table1. Measured manufacturing sectors. Based on [30]

Sector	Total companies
manufacture of plastic products	208
manufacture of rubber products	105
manufacture of other nonmetallic mineral products	196
manufacture of chemicals and chemical products	272
manufacture of basic metals and fabricated metal products	384
manufacture of food products and beverages	157
manufacture of electrical machinery and apparatus	147
manufacture of machinery –automotive	9
manufacture of machinery and equipment	117
manufacture of wood and wood products	36
manufacture of furniture	31
manufacture of paper and paper products	85
manufacture of printing, publishing, and reproduction of recorded media	29
manufacture of motor vehicles, trailers and semi- trailers	29
manufacture of other transport equipment	12
manufacture of coke, refined petroleum products and nuclear fuel	19
manufacture of medical, precision and optical instruments, watches and clocks	23
manufacture of wearing apparel, tanning and leather	19
manufacture of textiles	23
manufacture of radio, television and communication equipment and apparatus	52
manufacture of Tobacco products	3
manufacture of office, accounting and computer machinery	10
Recycling	3
other manufacturing activities not elsewhere classified	22
Total	**1991**

4.1.1. Sample Size Justification

With reference to SIRIM web site and FMM 2015 directory, 1991 certified industries in the different measured manufacturing sector are determined as industries certified to ISO 9001 QMS. As per the recommendations of Zainudin [78] exploratory factor analysis can be done on a sample of 100 basically for the pilot study gathered data. The study conducted by Habidin and Yusof [40] to determine Lean Six Sigma(LSS) construct, in the automotive industry in Malaysia, used a pilot study as 100 questionnaires sent to respondents, 57 were completed and gave response rate of 57 percent. *Authors of the present study sent 240 questionnaires to respondents in the pilot study, which is consistent with the guidelines assigned by Habidin and Yusof [40]*

4.2. Operationalization of the Constructs

In the present paper, both exogenous (TQM) and endogenous constructs (LM) are hypothesized as multidimensional constructs. Soft TQM is characterized and proposed by 20 indicators adapted from related literature whereas LM is characterized and proposed by 64 different indicators. These indicators are adapted from the literature review and both content and face validity were conducted in order to examine the validity and confirm the adequacy of the instruments used. The designed questionnaire was refined by academics from Malaysia, India, Palestine, Australia, USA and others. Upon receiving feedback from experts consulted in the field, questionnaire items were revised again. The following sections introduce the main hypothesized dimensions for both soft TQM and LM.

4.2.1. Soft TQM Dimensions

The items for Soft TQM are illustrated in Table 2. After considering the comments from the experts in the field, it is proposed that there are three main dimensions that can define the aspects of the soft dimension of TQM. These are: (i) strategic planning, (ii) human resource focus, and (iii) strategic quality policy. These are customized from the main concept of TQM philosophy or termed as people and human resources aspects. Strategic planning consists of seven items; human resource focus consists of six items and, finally, strategic quality policy consists of seven items. It is notable that these items are derived from valid and reliable instruments investigated by other scholars in different environments and the present study investigates these in the developing economy of Malaysia.

Table 2 . Soft TQM dimensions

#	Items	Study	Dimension
STQM1	Our company has clear, strategic objectives.	[66]	Strategic planning In general, there is not a commonly accepted definition for strategic planning. Coşkun [20] considers it as a component of strategic management. [13] defines strategic planning as "a deliberative, disciplined approach to producing fundamental decisions and actions that shape and guide what an organization (or other entity) is, what it does, and why". [20] argued that Strategic Planning is the initial stage and foundation of strategic management. Likewise, strategic quality management is among the major components of TQM.
STQM2	In our company, strategic objectives and plans are effectively communicated to all staff.		
STQM3	In our company, every staff member is aware of our strategic objectives and the action plans to be accomplished.		
STQM4	In our company, staff members are committed toward our strategic objectives and action plans.		
STQM5	We integrate public responsibility into performance improvement efforts.		
STQM6	Our staff adheres to a formal code of ethics.		
STQM7	We lead the efforts to improve the community services, such as education.		
STQM8	In our company TQM is successfully implemented, because Jobs and work for quality management are carefully designed.	[27]	Human resource focus (HR) is giving importance to employee in terms of providing opportunity to excel. Employees must be recognized for their achievements and equally rewarded to motivate them to perform better. Creating an environment where only merit gets berth. Training & development is an important activity which prepares the employee to respond effectively and efficiently towards changing business environment. Empowering employees is one of the most important aspects for building superior culture [27]. According to [20] Human Resources Management is the soft dimension of TQM. In TQM, providing employees with necessary training and ensuring the involvement of employees are necessities. Scholars [11] found that HR and strategic planning are among the key aspects that lead to strength of organizations.
STQM9	In our company TQM is successfully implemented because flexible work system exists.		
STQM10	In our company TQM is successfully implemented because effective communication takes place		
STQM11	In our company TQM is successfully implemented because employees are recognized for accomplishing their work related to quality programs.		
STQM12	In our company TQM is successfully implemented because employees are given adequate compensation (salaries and benefits) related to quality programs.		
STQM13	In our company TQM is successfully implemented because education and training are provided related to quality programs.		
STQM14	Our company has a clear long- term vision statement.	[76]	Strategic quality policy According to [76], Strategic quality management is the process of establishing long range quality goals and defining continuous improvements to meet organizational goals, such as improving processes, products, and service.
STQM15	Our company has an effective quality improvement plan.		
STQM16	Quality goals and policies are well communicated to the employees within the company.		
STQM17	The processes for designing new products and services in our company ensure quality.		
STQM18	In our company, employees involved in different processes know how to use statistical controlling methods to evaluate their processes.		
STQM19	Our company has a career road map for employees.		
STQM20	Our company encourages continual study and improvement of all of its products, services, and processes.		

4.2.2. LM Dimensions

On the other hand, the dimensions of LM include both soft and hard LM practices consisting of the different tools and techniques. It is proposed that these aspects together can minimize the wastes and the production costs. These dimensions are depicted in the following Table 3. The present paper produced a comprehensive LM model which proposed to consist of eleven different dimensions. These dimensions were adapted from previous valid and reliable instruments and refined by the experts and academics from different countries including Malaysia, India, Australia, Palestine, and others. In addition, the dimensions included in this section are adapted from Toyota Production System (TPS) model and revised to be consistent with the Malaysian environment. According to [50], LM is an integrative concept which can be adopted by selective set of keys or factors which are considered critical for successful implementation.

Table 3. LM proposed dimensions

Dimension	Definition	# Items	Reference
JIT delivery by suppliers	Just- in- time by using the quantity needed, the time frame required and assuring the best quality of product for the customer and this to operate in a faster way [45]	5	[14], [53], [12]
Setup time reduction	Setup reduction is a very useful lean tool for enterprises to eliminate wastes and improve production efficiency. It is an important tool in LM to realize quick setup change and meet the demands of individualized customers [19]. Setup time is total elapsed time from completion of the last good part from the previous setup to the first good part from the new setup.	6	[14], [58]
Continuous flow	Manufacturing where work-in-process smoothly flows through production with minimal (or no) buffers between steps of the manufacturing process. It eliminates many forms of waste (e.g., inventory, waiting time, and transport) [47]	6	[12], [58]
Total productive maintenance	Total productive maintenance ensures a better performance of the equipment by maintaining them in a good condition thus reducing the risk of troubleshoot and failure [45]	6	[12], [58]
Workforce Management	Workforce management affects flexibility because LM practices promote multi-skilled workers who can easily be assigned from one work center to another as dictated by production volume([75]; [44])	6	[44]
Kaizen	aims to involve all employees in the operation process and this training them and coaching them on their tasks([45]	6	[49], [58]
Waste Elimination	LM seven wastes, namely Over –production, Waiting, Transportation, Inventory, Over-processing, Motion, Defects [23].	7	[28]
5S Practice principles	The 5S is meant to be self-sustaining and the benefits are the results of a disciplined workforce [79], 5S steps are sorting (to eliminate useless items), shining (to keep workplace clean), setting in order (to keep everything in place), standardizing and sustaining (to assure continuity).	7	[31]
Kanban	It is a subsystem of the LM system which was created to control inventory levels, the production and supply of components [65]	5	[14], [36]
Standardized Work	To eliminate unnecessary inventory by the first line supervisors [45]	5	[69], [58]
Hejunika	A form of production scheduling that purposely manufactures in much smaller batches by sequencing (mixing) product variants within the same process. It Reduces lead times (since each product or variant is manufactured more frequently) and inventory (since batches are smaller).	5	[69], [58]

5. Results

Results of the present paper are summarized in three sub-sections; reliability analysis of the constructs is presented first while the remaining sub-sections are concerned with the exploratory factor analysis results. SPSS 22 was used to analyze the data gathered during the period September 2015 and January 2016 in this preliminary study.

5.1. Reliability Analysis

Shah *et al*. [64] considered that reliability of the instrument is most important during data collection phase. To calculate the reliability of the model, cronbach alpha was calculated for both STQM and LM dimensions and items, respectively. This was done through the statistical package for social science (SPSS 22). In the present paper, the reliability of the model will be estimated twice, before doing the EFA and after extraction the factors. Results showed that the latent construct is reliable as it is greater than the threshold (0.7) as recommended by [37]. This is depicted in Table 4.

Table 4. Reliability analysis for latent constructs

Construct	No. items	Cronbach Alpha	Result
Soft TQM	20	0.890	Acceptable
LM	64	0.920	Acceptable

From the results shown above, authors conclude that the proposed model in the present paper is reliable since cronbach alpha for all constructs and items are greater than the threshold value which is 0.7. This encourages authors to proceed with the next phase for data reduction.

5.2. Exploratory Factor Analysis (EFA)

Factor analysis is used for data reduction. In the present paper, it is applied for both Soft TQM as the exogenous and LM latent construct as the endogenous. EFA was conducted separately on each instrument. Before conducting EFA there are several assumptions to be tested including the followings:

Sample Size: According to Zainudin [78], to run EFA a sample size of 100 to obtain the dimensions is needed. In

the present paper, the sample size fulfill the minimum sample size required (n=102).

Adequacy of the EFA: was estimated through both (i) Kaiser-Meyer-Olkin measure of sampling adequacy (KMO). Hair *et al*. [37] suggested the acceptable value greater than 0.5 indicates that the variables have sufficient correlations. If the value is below 0.5, the variable should be dropped from the factor analysis. And (ii) the Bartletts test of sphericity to be significant. According to [68], Bartletts test of Sphericity should be significant (p value < 0.05) to represent that correlation between variables are large enough for factor analysis. Results of KMO and Bartletts test for both Soft TQM and LM are depicted in Tables 5 and 6, respectively. This was done after doing several iterations for each case.

Table 5 . KMO and Bartlett's Test for Soft TQM

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.807
Bartlett's Test of Sphericity	Approx. Chi-Square	375.516
	df	45
	Sig.	.000

Table 5 shows that KMO value for Soft TQM practices = 0.807 which is greater than the minimum level and indicates that it is an acceptable value. Furthermore, Bartlett's test was significant (p-value less than 0.05).

Table 6. KMO and Bartlett's Test for LM

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.779
Bartlett's Test of Sphericity	Approx. Chi-Square	1213.695
	df	325
	Sig.	.000

Table 6 shows that KMO value for LM practices = 0.779 is greater than the minimum level which indicates that it is an acceptable value. Furthermore, Bartlett's test was significant (p-value less than 0.05).

5.2.1. Extracted Success Factors

In the present paper, the number of factors extracted and retained for analysis was based on [37]'s recommendations that only factors that have eigenvalues more than 1 are considered significant. In addition, scree plots of the data set were utilized to determine the no. of extracted factors. Field [29] defined scree plot as a useful way of establishing how many factors should be retained in an analysis.

Factor extraction was conducted through Principal Component's Analysis (PCA) with varimax rotaton. PCA is a data reduction technique where the diagonal values of the correlation matrix, 1s, are used for the analysis to extract Maximum variance from the data set with each component thus reducing a large number of variables into smaller number of components [68]. Varimax rotation method is used in the present paper to minimize the number of variables that have high loadings on each factor and works to make small loadings even smaller [77]. It is the most common method in the orthogonal rotation.

First: Principal Component Analysis for Soft TQM (PCA)

Applying PCA through SPSS for 20 items for Soft TQM indicated that three factors have eigen values greater than 1 can be extracted. The final rotated component matrix resulted in 10 items, and the remaining items were discarded from further analysis as these have low communalities, cross loading issues, and low factor loading. This is presented in Table 7.

Table 7. Rotated component matrix for Soft TQM

Item No.	component 1	component 2	component 3
STQM3	.893		
STQM2	.841		
STQM4	.765		
STQM1	.709		
STQM9		.862	
STQM10		.754	
STQM8		.739	
STQM19			.821
STQM18			.770
STQM17			.713
Cronbach Alpha after EFA	**.844**	**.780**	**.705**
Cummulative Total variance Extracted %	39.291%	56.372%	68.734%

Based on Table 7, the factor loadings for all items are within the limits 0.709 and 0.893, which is considered among the acceptable range. The first factor comprises four items (ST 3, ST2, ST4, and ST1) while the second factor comprises three items, namely (ST 9, ST 10 and ST 8). The third factor also comprises three items (ST 19, ST 18 and ST 17). In addition, the values of crobach alpha after conducting PCA for the three factors are also still acceptable. The scree plot in Figure 2 indicates that there are three factors when the eigen value equals 1.

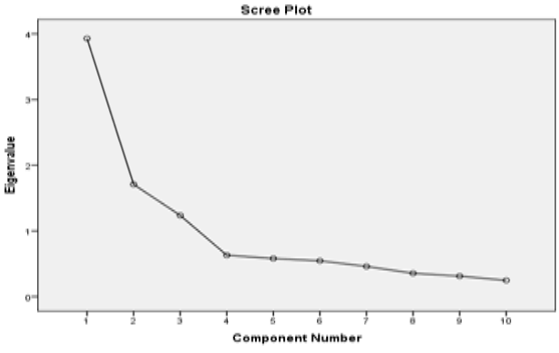

Figure 2. Scree plot for Soft TQM

Second: Principal Component Analysis for LM Practices (PCA)

In addition, applying PCA through SPSS for LM indicated that seven factors have eigen values greater than 1 can be extracted. The final rotated component matrix resulted in 26 items, and the remaining items were discarded from further analysis as these have low communalities, cross loading issues, and low factor loading. This is presented in Table 10

Table 10. Rotated Component Matrix for LM practices

	Component						
	1	2	3	4	5	6	7
LM57	.825						
LM56	.805						
LM58	.765						
LM55	.643						
LM3		.878					
LM2		.783					
LM4		.775					
LM1		.730					
LM27			.778				
LM28			.763				
LM26			.752				
LM24			.645				
LM38				.861			
LM39				.810			
LM37				.677			
LM36				.563			
LM17					.813		
LM12					.728		
LM13					.685		
LM14					.641		
LM20						.826	
LM19						.717	
LM21						.630	
LM31							.780
LM30							.751
LM33							.617
Cronbach Alpha	**.835**	**.839**	**.783**	**.863**	**.755**	**.703**	**.712**
Cummulative TVE %	24.162	39.224	46.395	53.035	58.876	63.663	68.199

Table 10 shows that factor loadings for all extracted factors range between 0.563 and 0.878 which considered an acceptable loading considering that the threshold is 0.55 [37]. Based on rotated component matrix, the first factor which is standardized work comprises four items, the second factor which is Just in Time (JIT) has four items. Factor three, namely workforce management, comprises four items; factor four also comprises four items and named as waste elimination. Factor five comprises four items and named as continuous flow. The last two factors each have three items. Factor six is TPM and factor seven is Kaizen. In addition, the cronbach alpha calculated for the extracted factors still acceptable. The scree plot in Figure 3 shows that there are seven factors based on eigen value which is 1.

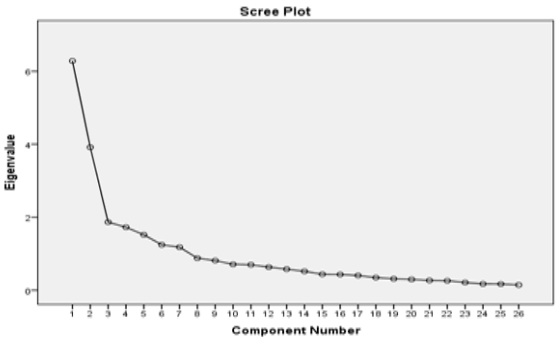

Figure 3. Scree plot for LM

6. Revised Model after EFA

After conducting PCA for both exogenous and endogenous latent constructs, extraction of factors for these initiatives will lead to develop the model based on Structural Equation Modeling. This is depicted in Figure 4. Investigation the hypotheses in this model will be among the future direction of the present paper.

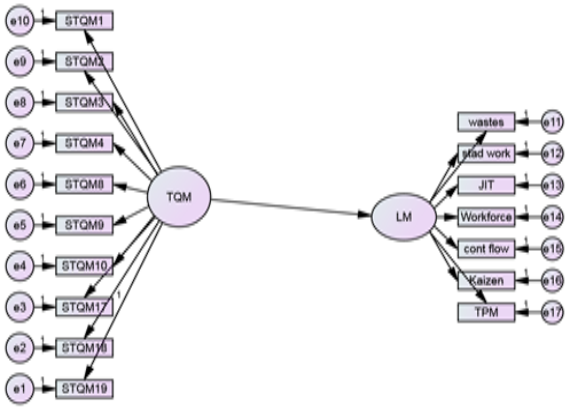

Figure 4. revised model after conducting PCA. Source: Authors computation

7. Discussion of Findings

The difference between the present paper and the other papers is linking both philosophies together in one multi-dimensional model and by investigating the most appropriate CSF for these practices. As per the results gained from SPSS 22 concerning factor extraction, seven factors were extracted for LM initiatives. These factors make this construct as multidimensional and saturated for implementation. It is considered as a guide for Malaysian manufacturers if properly practiced in the real world environment. This motivates Manufacturers to be leaner in 21st century in the Malaysian competitive market. Focusing on Lean wastes is among the top principles and aims of LM practice, this is also supported with Kaizen for incremental continuous improvement that manufacturers can observe in the production costs and perceived potential benefits and return on investment. Moreover, Just-in-time

production also extracted as significant component which specifies that Malaysian managers ensure an awareness of this production policy which minimizes the costs of inventory availability and production style. These are coordinated with the continuous flow and classification of the products into groups and better improve the factory layout and minimize waiting time for material flow in an efficient manner. Moreover, Total Productive Maintenance (TPM) is also considered among the priorities of operations and quality managers in Malaysian industries as it is extracted also among the other components. This is concerned with focusing on maintaining equipment's regularly and efficiently. Standardized work aims to ensure that work processes are standardized. In addition, it is considered as a basis for the improvement in different aspects. It also implies that the managers and employees receive a standardized process instruction. All these are important factors that align with Toyota Production System (TPS) principles and concept. With reference to Soft TQM dimension, this is a new variable to be considered and integrated with the other practices QMS, EMS, LM and SP in the same integrated model that can enhance the strategic long term sustainable performance and logistics approach in the supply chain environment. Results obtained from PCA indicated that three different components are extracted and have the higher importance among others. These practices are described as follows: strategic planning component. In general, there is not a commonly accepted definition for strategic planning. [20] considers it as a component of strategic management. [13] defines strategic planning as "a deliberative, disciplined approach to producing fundamental decisions and actions that shape and guide what an organization (or other entity) is, what it does, and why". [20] argued that Strategic Planning is the initial stage and foundation of strategic management. Likewise, strategic quality management is among the major components of TQM. Human Resource Focus (HRF) is the second component. Human Resource (HR) focus is giving importance to employee in terms of providing opportunity to excel. Employees must be recognized for their achievements and equally rewarded to motivate them to perform better. Creating an environment where only merit gets berth. Training & development is an important activity which prepares the employee to respond effectively and efficiently towards changing business environment. Empowering employees is one of the most important aspects for building superior culture [27]. According to [20], Human Resources Management is the soft dimension of TQM. In TQM, providing employees with necessary training and ensuring the involvement of employees are necessities. The third component is Strategic quality policy. According to Yeh [76], strategic quality management is the process of establishing long range quality goals and defining continuous improvements to meet organizational goals, such as improving processes, products, and service.

7.1. Conclusions

The present paper proposes that both TQM and LM are not in conflict inside Malaysian manufacturing industries as TQM is a driver for LM tools and techniques. The similarities aspects between both employ that these have to be integrated together inside enterprises. Their synergy can enhance the performance in the competitive market. Thus, it is argued that these are available in the same enterprise. A cross sectional quantitative study was conducted to investigate the proposed model adapted from reliable and valid instruments. The present paper shows results of the preliminary study termed as pilot study. Using LM multidimensional construct in developing industry is relatively new which focuses on the advanced techniques that can enhance the environment inside enterprises. This present study has many benefits to the operations managers as it reflects a clear view about how LM can be defined and measured in the manufacturing industries. Utilizing the elements of Toyota production system can help build a better design for LM and enable the smooth implementation inside enterprises. Awareness of these tools, techniques and approaches mentioned in the present paper can reinforce enterprises in this competitive world. Thus, it is vital to adopt these systems and philosophies together to be integrated in the same environment as there are many elements in common and have the same priorities. Both reliability and descriptive statistics we estimated for the model constructs. Furthermore, with reference to EFA, results directed that Malaysian managers are involved with LM waste elimination techniques, such as workers motion, overproduction waste, reducing the excess inventory, and waiting waste. These are all extracted factors from principal component analysis. Furthermore, the employees recognize the importance of Kaizen aspects and initiatives for the continuous improvement.

Production and quality managers are strongly advised to follow up the continuous improvement journey on the long term perspectives. Both TQM and LM are viewed as long term strategic philosophies and the implementation of these can generate high customer satisfaction, reduction of wastes, defects, costs and improving the productivity and quality on the long run. This will ensure realization of better performance and sustainable environment.

7.2. Limitations and Suggestions for Future Research

Similar to other studies conducted in Operations Management, the present paper suffers from limitations which, at the same time, can be considered an agenda for researches and scholars to cope with in their new research. Among these is using the cross sectional approach. Other researchers may adopt the longitudinal design to study in depth these practices. In addition, it will be a good opportunity to compare the results among both the developing and developed countries. The present paper focuses on introducing the results of the pilot study; hence, authors believe that further research is needed to empirically investigate the model using techniques from Structural Equation Modeling. As the present paper focuses on measured manufacturing sector, we recommend making use of this study in the service sectors, such as healthcare, banks, and education sector since the practices implied can fit the different sectors on the long run.

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