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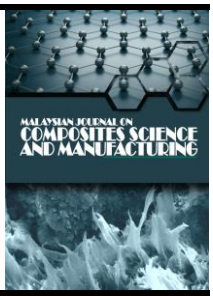

Modelling Total Quality Management in the Malaysian Composite Manufacturing Industry

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ABSTRACT

This paper investigates the enabler factors of total quality management (TQM) practices for a composite manufacturing company in Melaka, Malaysia. Leadership (L), training and education (TE), supplier management (SM), customer focus (CF), benchmarking (B), continuous improvement (CI), employee relations (ER), and strategic planning (SP) were considered in this paper. They are the critical TQM elements that influence TQM processes (Y). A questionnaire was used to collect data from 27 employees of a composite manufacturing company in Melaka, Malaysia and analyzed using multiple regression analysis. Five out of the eight hypotheses positively fit with the conceptual model and show a positive effect of TQM practices. The research findings indicate that enabler factors, namely leadership (L), continuous improvement (CI), supplier management (SM), benchmarking (B) and strategic planning (SP), have positive and significant effects on successful TQM practices. This study would benefit managers significantly to increase strategic planning, supply chain management, and benchmarking through TQM practices.

1. Introduction

For a few decades, total quality management (TQM) has been one of the most crucial factors that any business requires for outstanding performance, especially in the manufacturing industry [1]. Subsequently, TQM practices are viewed as a critical management standpoint in achieving corporate objectives and maintaining exceptional performance. Several studies have been carried out to

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investigate the impact of TQM on organizational performance [2–7], service performance [8–11], customer satisfaction [11–13], and knowledge management [14], to name a few. Previous research has evaluated and explored many critical factors to assess the effectiveness of TQM approaches on performance [15].

This study investigates the relationship between enabling factors and a composite manufacturing company's total quality management (TQM) practices. In Malaysia, there have been several research studies conducted on TQM practices, such as in the construction industry [16], research and development units [17], SME industry [18] and hotels [7] that could be a guideline for the composite manufacturing company. However, their findings are inconclusive because they are different in nature, and each organization requires different kinds of practices based on its needs [19]. Despite the Covid-19 pandemic throughout 2020, the manufacturing industry contributed 9.1% to Malaysia's gross domestic product (GDP) in Q4, 2021 [20]. In this regard, the study of the factors that enable the successful implementation of TQM in the manufacturing industry for composite manufacturing companies is still relevant. Further, composite manufacturing companies use manual handling processes to produce the components, which means the quality of the process is the company's priority. Further, not all existing quality systems are suitable for all conditions, and currently, the composite manufacturing company requires changes that can fit and improve the quality process [21].

With the points presented above, it is evident that further research into the relationship between enabling factors and TQM practices in the context of Malaysian composite manufacturing companies focusing on the aviation industry is required. Such a study should provide a theoretical yet practical platform for service and manufacturing companies to acquire long-term competitive advantages. As a result, the following are the study's research objectives:

1. To study the primary factors that influence TQM practices
2. To propose a TQM practices model for the composite manufacturing company.

2. Literature Review

Total Quality Management (TQM) has attracted a lot of interest from the late 1980s to the present because it implements the eight quality management concepts formalized by ISO 9000 and 9001 [22]. TQM focuses on customer satisfaction and expectations through process quality, operating system, product quality, service quality, and organization according to ISO 9001:2015. This study's understanding of the concept of TQM as (1) total assumes that all individuals (employees and suppliers) associated with an organization contribute to process quality management (2) quality is an integral part of the corporate philosophy, and (3) environmental refers to the top management responsibility and relevance of managerial commitment.

The dynamic and active nature of TQM requires an organization to identify the critical success factors for assisting the implementation of TQM within their organization. The characteristics prominent in these factors are considered essential elements for achieving successful TQM implementation within any company. For example, a study investigating the implementation of TQM practices in the Turkish manufacturing industry [23]. The assessed factors include knowledge process management, leadership, supplier quality management, training, customer focus, and strategic quality planning. This study shows that TQM in Turkey lacks employee involvement, inappropriate organizational structure, awareness and commitment of the employees, and a lack of resources to hinder its effective implementation. Similarly, a study conducted for the Pakistani Aviation Manufacturing Industry (PAMI) adopted TQM's eight well-established dimensions, namely top management support, quality information availability, quality information usage, employee training,

employee involvement, product/process design, supplier quality, and customer orientation for transforming into the high-tech developed industry [4].

Halim et al. [24] studied the possible critical success factors of the TQM model for the Malaysian aerospace industry. They found 11 crucial success factors classified into four main factors: organizing, systems and techniques, measurement and feedback, and culture and people. By using a fuzzy analytical hierarchical process, the findings revealed that culture and people are the most critical factors for successful TQM adoption, with a weight of 0.434, followed by organizing (0.296), systems and method (0.151), and measurement and feedback (0.119). Another study by Salleh et al. [25] used descriptive analysis to model TQM practices at a public university in Malaysia. However, the critical success factors were limited to managerial ability in successfully implementing TQM in higher education institutions.

A recent study by Jong [16] involved TQM and project performance in the Malaysian construction industry. Their TQM model employed six critical success factors: management, leadership, customer focus, strategic planning, operation focus, workforce focus, and finally, measurement, analysis, and knowledge management. As a result, TQM in the construction industry requires leaders and managers to stress workforce and operation focus for superior performance.

Meanwhile, a study conducted by Samsudin et al. [26] encompassed communications of TQM practices and other factors of TQM practices besides communication. They covered Pareto analysis policy and planning, trust and empowerment, reward and recognition, process management, supplier management, involvement, teamwork, customer focus, training and education, and leadership and management. They found that communication is the fifth most important factor of TQM practices.

In summary, the TQM model for manufacturing companies that focus on Malaysia's aviation industry is scarce. Although several studies have examined the TQM model in manufacturing and services industries, these studies are not suitable for the aviation industry as their products are custom-made. This gap motivated this study to propose a TQM model and subsequently identified a list of critical success factors for the proposed model.

3. Methodology

Based on the gaps and problems found in the previous section, this paper has identified the most significant factors contributing to TQM practices based on the frequency mentioned in the literature. Figure 1 illustrates the conceptual model that depicts the association between the variables and the hypothesis. This paper suggests a positive relationship between all identified critical factors and the dependent variable (TQM practices).

This paper will test the hypothesis relationship using a quantitative methodology. This study aims to examine if all of the chosen enabler factors are significantly related to TQM practices.

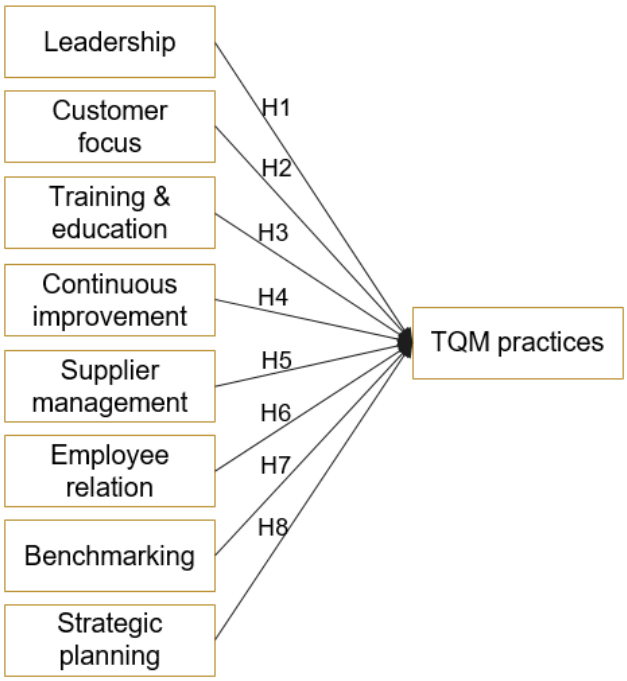

Fig. 1. Conceptual framework

3.1 Sample and data collection

A convenient sampling approach was used to determine the respondents. Data were acquired from the manager of the Human Resources Department in a Composite Manufacturing company in Melaka, Malaysia, via a self-administered questionnaire survey utilizing pen and paper. The company was chosen as one of the biggest composite manufacturers in Malaysia with planning to practise TQM in the business.

While measuring numerous constructs, the study also took employee perception into account. Prior to performing the survey, a draught survey was validated by both academicians and practitioners to ensure the content validity of the survey questionnaire (i.e., two senior managers from the manufacturing industry). Participants were asked to rate the survey questionnaire based on its phrasing, clarity, and relevance. The surveyor initially obtained permission from the Human Resources and Quality Managers to survey their staff, and only the final version of the questionnaire was used to collect data. A purposive sampling method was used in this study as their Human Resources Department identifies the number of samples. According to the Human Resources Department, only 27 employees are in charge of quality matters and are responsible pertaining the challenges confronting quality issues in this organization. The survey was conducted over the course of one week, from November 8 to November 14, 2021, and the response rate was relatively high, with a total of 27 usable questionnaires returned, producing a 100% response rate.

3.2 Questionnaire development

A five-point Likert Scale was used to measure the constructs in this study. Eight dimensions for critical factors of TQM and TQM practices, as presented in Table 1, were measured using 84 items adapted [23, 27-29]. A Likert scale ranging from “1” (strongly disagree) to “5” (strongly agree) was used to measure the factors. Table 1 shows the development of the constructs used in this paper.

Table 1
The questionnaire to the selected respondents

Constructs	Label	Dimensions	Sources	No. of items	Rating scale
Leadership	L	The commitment and support to quality practices by top management.	[16],[23], [27],[29]	10	1=strongly disagree, 5 = strongly agree
Customer Focus	CF	The ability to assess customer relation, customer satisfaction, and customer involvement.	[3],[14],[16], [26]	10	
Training & Education	TE	Employees' knowledge, experience, and action related to quality practices.	[23],[30],[31]	10	
Continuous Improvement	CI	The effort to improve the processes, products and services.	[14],[31],[32]	10	
Supplier management	SM	The effort to improve supplier involvement, supplier relation, supplier loyalty.	[23],[31],[33]	10	
Employee Relation	ER	The assessment of employee involvement, employee empowerment, employee participation in quality practices.	[7]	10	
Benchmarking	B	The assessment compares and measures the performance goals with business leaders.	[11]	10	
Strategic Planning	SP	The propensity to develop and implement strategic organizational actions.	[29]	10	
TQM practices	TQM	The organizations achievements in regards to their quality planning	[29]	4	

3. Results

This study used SPSS version 16 to examine the data. This section presents the descriptive statistics and correlations of the variables analyzed.

Table 2 presents the demographics of the sample. Demographic analysis was used to provide an overview of the profile of respondents at the manufacturing company. As clearly noticed in the table, most of the 27 quality department employees were males (63%) at the young age of 31 - 35 years old (59.3%). In addition, most of the respondents were quality officers (55.6%), and some of them had working experience of 3 - 4 years.

Table 2
The respondents' profile

Variable	Frequency
Gender	
Male	17(63%)
Female	10(37%)
Age	
26-30	7(25.9%)
31-35	16(59.3%)
36 and above	4(14.8%)
Position	
Senior executive	5(18.5%)
Operating officer	7(25.9%)
Quality officer	15(55.6)
Year of service	
1-2 years	8(29.6%)
3-4 years	13(48.1%)
5 years and above	6(22.2%)

Cronbach's alpha was employed to examine the internal consistency of all items under the various factors. Cronbach's alpha coefficients greater than 0.70, according to Hair et al. (2006), are appropriate for basic research [34]. The reliability of each construct was tested using Cronbach's a, which varied from 0.725 to 0.853 in the experiment, demonstrating that the scales are internally consistent and relatively free of measurement error.

Table 3
Reliability of various factors

Constructs	Cronbach's Alpha	Number of statements
Leadership	.853	10
Customer focus	.760	
Training & education	.880	
Continuous improvement	.725	
Supplier management	.826	
Employee relation	.812	
Benchmarking	.788	
Strategic planning	.777	
TQM practices	.854	4

A multiple regression analysis was used to predict the most influential factor for TQM practices at a composite manufacturing company focusing on the aviation industry. The independent variables were leadership (L), training and education (TE), supplier management (SM), customer focus (CF), benchmarking (B), continuous improvement (CI), employee relations (ER) and strategic planning (SP). Table 4 shows that the multiple regression coefficient R = 0.969 implies a positive association between the TQM factor and TQM practices. Furthermore, the value of R squared is 0.939. This suggests that the TQM factor may explain the 93.9 percent variation in TQM practises. It is seen that the corrected R2 value is quite close to the value of R2. If the modified R2 is removed from the Equation, then R2 (0.939-0.910) = 0.029. This small decrease (0.029) suggests that if the model has been fitted when the entire population participates in the study, the outcome will have 0.029 less variances.

Table 4
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.969[a]	.939	.910	.13847

a. Predictors: (Constant), SP, CI, SM, L, CF, TD, B,

Table 5 shows the analysis of variance (ANOVA), which is used to test the main hypothesis statistically. ANOVA uses the F-test to determine whether or not a model fits the data appropriately. The table shows that the independent factors statistically significantly predict the dependent variable, $F(8,17) = 32.469$, $p<0.01$. Thus, we can conclude that the model is a good fit for the data.

Table 5
ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.981	8	.623	32.469	.000[b]
	Residual	.326	17	.019		
	Total	5.307	25			

a. Dependent Variable: TQM
b. Predictors: (Constant), SP, CI, SM, L, CF, TD, B, ER

The next analysis tests the individual factors that contribute to the TQM practices. Referring to the estimated model coefficients as shown in Table 6, it was found that supplier management ($t = 14.588, p < 0.01$) and leadership ($t = 3.313, p < 0.01$) have highly significant contributions to TQM. Other factors such as continuous improvement ($t = 2.502, p < 0.05$), benchmarking ($t = 2.141, p < 0.05$) and strategic planning ($t = -2.392, p < 0.05$) also have a significant impact on TQM. This result is in tandem with the previous studies by Sadikoglu and Olcay [23] and Amin et al. [7] for continuous improvement and leadership.

Table 6
Regression Analysis of Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.046	.536		-.087	.932
	L	.133	.040	.233	3.313	.004
	CF	.027	.043	.041	.629	.538
	TD	.017	.052	-.031	-.323	.750
	CI	.223	.089	.272	2.502	.023
	SM	.706	.048	.938	14.588	.000
	ER	.061	.084	-.081	-.727	.477
	B	.184	.086	.220	2.141	.047
	SP	.186	.078	-.241	-2.392	.029

a. Dependent Variable: TQM

Therefore, the regression model is given as in Eq. 1:

$$\text{TQM} = 0.046 + 0.133(L) + 0.223(CI) + 0.706(SM) + 0.184(B) + 0.186(SP) \quad (1)$$

Table 7 shows the summary of hypothesis testing in the study. Comparing the results as indicated in Table 6, three factors, namely, customer focus ($t = 0.629, p > 0.05$), training and development ($t = -0.323, p > 0.05$), and employee relations ($t = -0.727, p > 0.05$) had a negative but not statistically significant association with TQM practices in the Composite Manufacturing industry. Therefore, H2, H3, and H4 were not accepted. The summarized results indicate that only five variables of TQM practices, leadership, continuous improvement, supplier management, benchmarking, and strategic planning, had statistically significant associations with TQM practices. Thus, the collected data supports H1, H4, H5, H7, and H8.

Table 7
Results of the model

Hypothesis	Linkages in the model	Proposed effect	Standardized path coefficient β	Remarks
H1	L→TQM practices	+	0.233	H1 supported
H2	CF →TQM practices	+	0.041	H2 rejected
H3	TD→TQM practices	+	-0.031	H3 rejected
H4	CI→TQM practices	+	0.272	H4 supported
H5	SM→TQM practices	+	0.938	H5 supported
H6	ER→TQM practices	+	-0.081	H6 rejected
H7	B→TQM practices	+	0.220	H7 supported
H8	SP→TQM practices	+	-0.241	H8 supported

This study aims to identify the most influential factors for TQM practices in the composite manufacturing industry. From the respondents in the quality department, the current research findings reveal that leadership is one of the most important factors in successfully practising TQM. This concurs with the findings by Sawaean and Ali [35] and Kamat et al. [36], who confirmed that leadership affected TQM practices. Also, the results are in line with Glaveli et al. [37], leadership has a significant impact on the implementation of TQM to achieve teacher satisfaction in primary and secondary education. Therefore, the findings imply that leadership is one of the key drivers of successful TQM practices, as leaders drive their employees to achieve their vision and mission.

Moreover, study results also support the relationship between continuous improvement and TQM practices. This study is consistent with the relationship between continuous improvement and TQM practices. This study is consistent with Pambreni et al. [18], Glaveli et al. [37] and Kumar and Sharma [38]. They point out that continuous improvement is the most useful variable for TQM practices to enhance quality and maintain superior performance accordingly in the manufacturing industry. More specifically, this result determines the main role of teamwork and employee dedication in encouraging a bottom-up urge for quality improvement and successful implementation of TQM [39-40].

This study found that supplier management is another important factor for TQM practices in the manufacturing industry, as agreed by Valmohammadi [30] and Yazdani et al. [1]. According to Valmohammadi [30], managing suppliers properly will ensure TQM practices' success and eventually improve organizational performance. In addition, leaders in TQM practices should communicate the strategic plan created so that employees can clearly understand the organization's plan to achieve the organization’s quality objectives. This study is per previous studies conducted by Pambreni et al. [18], who showed that a strategic plan positively impacts TQM practices at SMEs in Malaysia to achieve superior performance. They found that strategic planning has a positive and significant impact on an organization's performance.

This study also found that strategic planning is one of the key factors for TQM practice organizations. This study is in line with Ray and Ramakrishnan [41], who claimed that human resources are critical to the achievement of TQM because they can encourage innovative production among employees. They should act as strategic partners and design strategies to boost the organization's innovation performance. Also, in line with Pambreni et al. [18], which revealed that top management commitment comes up as an essential performance predictor for organization performance in the service sector SMEs. It has been found that supplier management is positively related to TQM practices and is consistent with the study conducted by Sadikoglu and Olcay [23] and Mosadeghrad [6]. Appropriation of supplier management creates sustainable competitive advantage [42]. As composite manufacturing is responsible for providing products to their worldwide clients,

managing suppliers throughout the whole supply chain is important so that each partner tries to do their best to provide quality products. From the perspective of benchmarking as one of the important factors for TQM practices, the findings of this study are in tandem with previous studies [37], [43-44], which said that benchmarking is an excellent practice to improve the process and product quality in composite manufacturing.

4. Conclusions

The statistical results support that the composite manufacturing industry has recognized the importance of quality management in its practices. This study shows some differences from the research findings of the models of manufacturing and services. The scenario differs in aviation (service) due to differences in the management structure of airports and airlines, type of passengers, the intricacies of process and service, and service delivery. Repeated output in manufacturing allows for standard settings and operational certainty.

The findings show that the industry will have successful TQM implementation through quality management practices such as leadership, continuous improvement, supply chain management, benchmarking, and strategic planning. However, the factor of training and education is poor and needs to be improved. Frequent and recurrent training and education schemes can help build clear action plans for employee education and enlist the assistance of lower-level staff. Management and quality forums must respond to this problem with a well-thought-out action plan. It is also observed that employee relations are moderate, which can be improved by giving incentives and improving the quality process. Customer focus is to be given more priority by the composite manufacturing company. Top management should evaluate the strategic importance of customer satisfaction, care and support while practising TQM for improved organizational performance.

This study has its limitations. The research study was carried out with some constraints, such as the number of employees. As can be seen, there were only 27 collected data in this study, which hindered the generalization of findings. The future study could be explored to test some other leadership styles like transformational, autocratic, laissez-faire, participative, visionary and charismatic. The future study could be explored to test some other leadership styles like transformational, autocratic, laissez-faire, participative, visionary, and charismatic in the current framework, which may provide a different perspective for future TQM practises in Malaysia. Overall, TQM is a holistic approach that should be implemented collectively because each practice is interdependent with the other practices.

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