Soft Dimension of TQM: A Validation by Confirmatory Factor Analysis (CFA)

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The purpose of the research is to test the theory with confirmatory factor analysis (CFA) executed the validation of the first-order and second-order factor analysis to demonstrate the perspective of soft-TQM dimensions. The technique is used by positivism analysis to establish the theory traits of the soft-TQM that are identified empirically and confirmed by the goodness of fit parameters of incremental fit and absolute fit parameter through CFA analysis. The findings of all dimensions have demonstrated that all parameters are achieved good fit of the soft-TQM construct as a part with two extents of first-order and second-order factor analysis. Yet, the analysis showed in the goodness of fit enabled to perform the two indications of the measured variables are valid. The outputs of the research are also recommended potential implications for the soft-TQM that are supported by three dimensions of leadership, employee relations, and customer relations as a central part of the soft strategy. Finally, the results demonstrated a further analysis scope to predict the construct of the soft-TQM to measure the formative validation with the same dimensions that are fitted as well.

Key words: *Soft-TQM, CFA, leadership, employee relations, customer relations.*

Introduction

Total Quality Management (TQM) is a quality management practice that focuses on customer needs and process improvements (Psomas, Kafetzopoulos, & Gotzamani, 2018). Since 1980 its introduction in the United States, the emergence of TQM has been one of the most significant quality management development in the past two decades (Fargnoli, Costantino, Di Gravio, & Tronci, 2018). The implementation of TQM is considered to be an organizational change which requires a significant commitment to transfer the culture (Andrade, Mendes, & Lourenço, 2017), the processes, the strategic objects, and the confidence structure of the

business (Motwani, 2001). The potential problem is associated with an unsuccessful implementation of TQM includes a poor organizational culture, minimal leadership support, and inadequate training (Nasim, 2018). However, properly focused efforts associated with the use of TQM can lead to improved production methods, proper allocation of resources (Aliyu, 2016), as well as improvements in production and management efficiencies (Fargnoli et al., 2018).

TQM has grown from being a strict, systematic, statistical methodology to an all-encompassing of operational excellence increasing recognition of the important human factors in successful TQM implementation (Joiner, 2007). The theory that strengthens TQM is well documented and supported by considerable empirical evidence. On the other hand, Environmental Management systems provide additional facilities to adopt more comprehensive (Kafel & Casadesus, 2016) because of their resources and capabilities, such as export, employee commitment, and environmental research and development, overall facility stage in business performance (Darnall, Henriques, & Sadorsky, 2008). Quality products with competitive prices have increased nowadays. Moreover, customers from developed countries like Europe and North America were demanding for shipping services and products with high-quality characteristics more than ever (Fargnoli et al., 2018). Although, environmental issues are meet only the minimum standard of any certified companies but not touch too the high performance itself factories need to follow proper environmental management systems to gain competitive advantages against similar factories (Smit, 2010). Yet, many business fail to well structure or sustenance nonstop enhancement initiatives which eventually trouble them to failure (Gharakhani, Rahmati, Farrokhi, & Farahmandian, 2013). Therefore, factories need to understand and determine their strengths based on what they can achieve from the soft TQM.

The research objective is to confirm the theory by CFA analysis, which is the traits of soft TQM dimensions that are measured namely-leadership, employee relations, and customer relations. Therefore, these three soft dimensions become a positive indication from TQM to explore survey data from theoretical conception justification.

Literature Review

In this section, the literature review is to conduct the latest sources compare with the very beginning of the theory when it is necessary to justify the theory. Therefore, the following sub-sections have described pointedly.

TQM

Total Quality Management (TQM) is a continuous process, which is mainly two segments that are soft TQM and hard TQM. However, in this research, the literature is conducted only with soft TQM as focused on soft dimensions to confirm the theory traits of TQM. In soft TQM

there are three main core dimensions are leadership, employee relations, and customer relations traits of soft TQM, which are elaborated with section wisely.

Leadership

Leadership is one of the main driving forces traits of Total Quality Management (TQM) (Bajaj, Garg, & Sethi, 2018) which is considered the foremost influential element from other TQM aspects, particularly in the manufacturing industry. Top management commitment is influenced by employee performance and quality enhancement which is fully important for preparing a business culture of TQM practices (Qin, Huang, Hu, Schminke, & Ju, 2018). Therefore, TQM has reflected business operation keeps for future strategies in the route of objectively for a long and shorter period of goals. However, leadership is about the organizational performance teams, groups, and organizations (Burnes, Hughes, & By, 2018), thus transformational leadership related to follower job satisfaction and team performance (Burnes et al., 2018; Qin et al., 2018). Nevertheless, the leadership style is indicating a significant contribution to soft TQM, whereas all of the decision has made under this indication within the organization carrying the main core just after the top management (Qin et al., 2018).

Employee Relations

The second-dimension employee relation of soft TQM is highly indicated for the operation phase. In total quality, management-employee relations are always influenced by leaders (Qin et al., 2018), yet it participates the employee relations that are needed to be adequately trained and be aware of benefits of TQM practices (Bryson, Forth, & Stokes, 2017; Qin et al., 2018). Employee relations retain the working environment is sustained that is attachment to the employee's relation better for quality and production. In quality management-employee, relations are very much important for continuous improvement for its product and quality simultaneously. Empowering and involving employees for making continuous progress is essential for workplace performance through the development and retention of employees enhancing capability (Bryson et al., 2017; Naim & Lenka, 2018). Therefore, employee relation is a significant impact on the soft dimension, which is demonstrated as traits of TQM in the part of soft quality management.

Customer Relations

The ability to manage customer relations of TQM practices has one of the most crucial aspects of the business operation to expand business growth (Banyte & Dovaliene, 2014; Nasim, 2018). Customer relations enhancement is an integrated competitive advantage of TQM practices particularly in developing countries such as Bangladesh (Banyte & Dovaliene, 2014). Therefore, organizations are required to engage with their customer demand for identifying practices that are increased to customer satisfaction level (Nasim, 2018; Qin et al., 2018). However, a good customer relationship is helped to become cohesive of sustainable

competitive advantage (Banyte & Dovaliene, 2014; Qin et al., 2018). Therefore, TQM practices have a stronger impact on customer relations indication. In most of the literature suggested that top management leadership, employee empowerment, and customer enhancements are considered of the TQM practices for most essential principles (Qin et al., 2018). Although, customer relations have generated value creations (Banyte & Dovaliene, 2014), which are assumed that the relationship with customer satisfaction makes better relations enhancement.

Methodology

A research methodology is the tools and techniques that are used to conduct the study on how to execute the data analysis method. However, in this study, the method is used for quantitative analysis to demonstrate the theory traits of soft TQM dimensions are measured and confirm the goodness of fit parameters of incremental fit and absolute fit parameter with confirmatory factor analysis (CFA) analysis. Before running the CFA analysis the survey data is conducted with exploratory factor analysis, which confirms the factor loading of each measurement variable is achieved with the desired cut-off point at ≥0.50 (Meade & Kroustalis, 2006). In CFA analysis can improve model estimation and fit. Yet, acceptable model fit is authoritative for CFA tests of dimension invariance that is frequently used (Meade & Kroustalis, 2006). However, the test of item indicators in a CFA model can have thoughtful negative effects on tests of measurement variables. Consequently, the goodness of fit with a p-value at Sig. when the level becomes ≤0.05, CFI ≥0.90, GFI ≥0.90, AGFI ≥0.80, TLI ≥0.90, RMSEA 0.08, and CMIN/DF <5.0 traits of indications for absolute and incremental fits (J.F. Hair, Black, Babin, & Anderson, 2010). Therefore, these two fits are executed in the following section of data analysis to confirm the theory with surveyed data outputs that reach the above-mentioned parameters.

Data Analysis

In this section, data has executed to confirm the CFA analysis therefore before conducting the CFA analysis the exploratory factor analysis (EFA) makes sure to go for the next analysis such as CFA analysis.

Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) is executed which is indicated as an effective instrument for the examination of principle variable instruments orderly simplification of interrelated observed of the variable measured which common in EFA difference (Bryant & Yarnold, 1995). The interval level can be measured the adequacy of sample test and the strength of indicators relationship through KMO and Bartlett's Test of Sphericity (Barlett, 1954; Kaiser, 1974) become appropriated. The following table of soft TQM dimension items for EFA has performed.

Table 1. EFA test for soft TQM dimensions

Kaiser-Meyer-Olkin measure of sampling adequacy			.889
Bartlett's test of	Approx. Chi-Square		5399.349
Sphericity	df		105
	Sig.		.000

Items	Component		
	1	**2**	**3**
LS1	.662		
LS2	.807		
LS3	.835		
LS4	.827		
LS5	.831		
ER1		.820	
ER2		.870	
ER3		.832	
ER4		.789	
ER5		.664	
CR1			.739
CR2			.781
CR3			.872
CR4			.876
CR5			.838

Note- Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
LS-leadership, ER-employee relations, CR-customer relations.

The accepting value of KMO analysis is 0.50 or more and if the values between 0.5 to 0.7 medium and 0.7 to .08 or more than values are good with Bartlett's test of correlation required $p<.05$ (Andale, 2017; J. Hair, Black, Babin, & Anderson, 2006). However, total variance cumulative is achieved 0.889 which is by 88.9% that is good with Bartlett's test of correlation required by achieved sig. the p-value is less than 0.001. The measurement items of each value have demonstrated more than a cut-off point at 0.50. Therefore, the component matrix of measurement items has achieved more than the desired value and EFA test outputs conform to ready for further analysis such as CFA analysis.

Confirmatory Factor Analysis (CFA)

CFA is a multivariate statistical and quantitative data analysis method that is fitted a family of Structural Equation Model (SEM) techniques is used to examine how well fit of measured variables signify the number of constructs and it is indicated to confirm or reject a measurement theory (Betsy McCoach & Newton, 2016; Mueller & Hancock, 2015). However, CFA is an

appropriate technique to measure quantitatively by an estimate of the construct validity and reliability based on a theoretical model (Joseph F. Hair, William, Barry, Rolph, & Ronald, 2010). Therefore, empirical data demonstrated through first-order and second-order CFA analysis below.

First-Order CFA of Soft-TQM Dimensions

The following figure demonstrated for CFA of first-order TQM constructs latent factor structure fit the empirical data that was collected. Factor loadings are above 0.50 shows that very good latent variable indicators that were expected in this research observed. Generally, factor loading above cut-off point (0.50) shows those very good latent variable indicators which are expected of observed data for the model fit (Joseph F. Hair et al., 2010).

Figure 1. First-Order CFA analysis of Soft-TQM dimensions
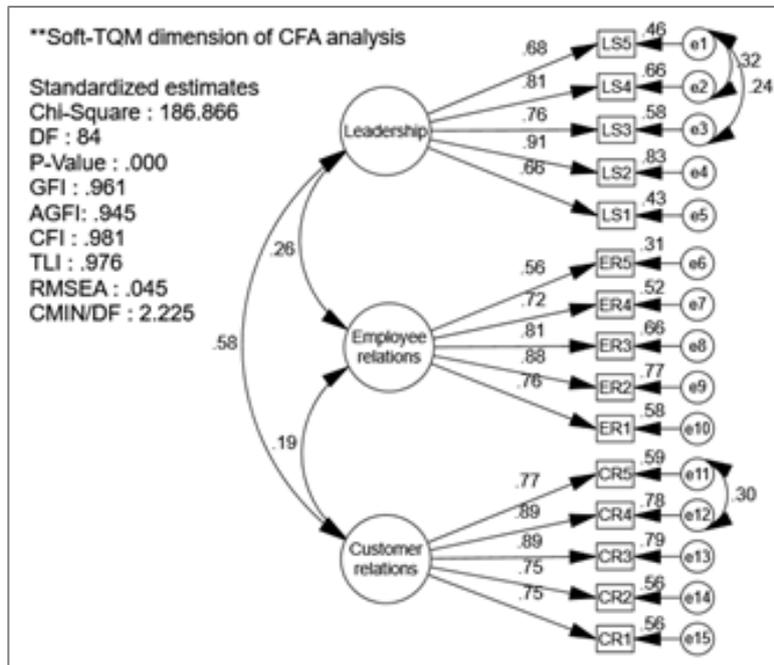
Moreover, in CFA rule thumbs for the measurement model, incremental fit measures by the cut-off line value of GFI, CFI, and TLI should be ≥0.90 and AGFI should be ≥0.80, and for the RMSEA value below than 0.08 indicated model become good fit (Joseph F. Hair et al., 2010). Therefore, TQM practices of soft dimensions CFA measurement model is tested and results of GFI is 0.961, CFI is 0.981, TLI is 0.976, AGFI is 0.945, and RMSEA is 0.045 which is suggested and provides a good fit and it is fitted in the further test such as structural model. Modification indices are conducted of covariance improvement error terms within a single latent construct between factors that can make big improvement correlate with the error term between two questions (Joseph F. Hair et al., 2010). In the soft dimensions of TQM practices model, modification indices are correlated between error terms (e1 ↔ e2) and error term

between (e1 ↔ e3) of leadership construct. Another modification is conducted in the customer relations construct between error terms (e11 ↔ e12).

Therefore, the error is associated with the same latent factor that did covariance. However, three error terms of covariance are counted that fit index above point 0.90 and below point 0.08 of RMSEA.

Second-Order CFA of Soft-TQM Dimensions

The following figure of measured variables of the second-order model for TQM practices construct is showing the results of three dimensions of TQM practices. However, to validate of each dimension of TQM practices and there is a rule of thumb for preliminary through four assessments are identified for CFA which are path coefficient (β), t-statistics (C.R.), R-square (R^2), and p-value which is known as coefficient determination (Joseph F. Hair et al., 2010). However, the second-order CFA analysis of soft-TQM dimensions CFA measurement model is tested and results of GFI is 0.961, CFI is 0.981, TLI is 0.976, AGFI is 0.945, and RMSEA is 0.045 which is suggested and provides a good fit with CMIN/DF is 2.225 that is fitted in the further test such as structural model.

Figure 2. Second-order CFA analysis of Soft-TQM dimensions
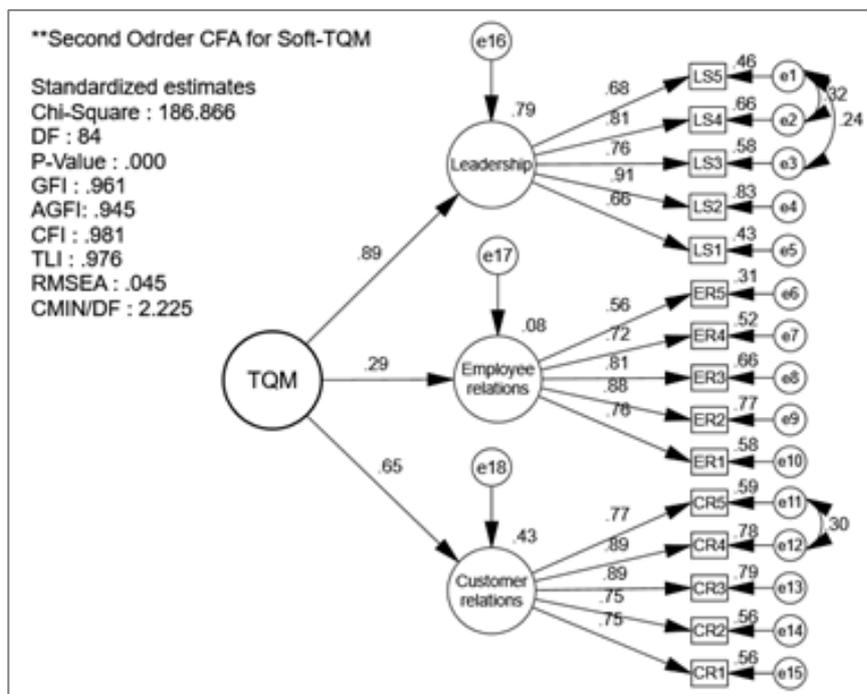
Therefore, the following table of second-order standardized regression estimates of soft-TQM dimensions demonstrated the path coefficient with three dimensions relationship is mentioned accordingly.

Table 2. Second-order standardized regression weights for TQM

Path Structural Relationships	Estimate	S.E.	C.R.	P	Results
Leadership <--- TQM	.890	Regression weight of reference			
Employee Relations <--- TQM	.291	.073	4.287	***	Accepted
Customer Relations <--- TQM	.655	.167	4.779	***	Accepted

According to the rule of thumbs, there are criteria for the path coefficient values are considered 0.10 as small, 0.15 as a medium, and 0.35 considered as high respectively (Cohen, 1988). Normally, the value of R^2 is considered as determination of coefficient goodness of fit summary statistics while the value is below than 0.10 is low, above 0.20 is moderate, and if the value is more than 0.30 as considered is high (Colin Cameron & Windmeijer, 1997). However, in social science rather than pure science R^2 value of.20 is considered a high indication (Joseph F. Hair et al., 2010). Therefore, three dimensions of leadership, employee relations, and customer relations have a strong path with TQM as soft dimension, where critical ratio (C.R) achieved more than 1.96 with the p-value of less than 0.000 that is ≤0.001. However, path relationships indicated statistically significant that accepted and confirmed both models are demonstrated as soft-TQM dimensions.

Discussion & Conclusion

The results of the dimensions in the two segments of first-order and seconder constructs have established by its good fitted parameters. In the first-order parameters, the correlation among the constructs is highly indicated relation with statistically significant. The factor loadings are demonstrated to measure the constructs. Yet, covariance is significant within the measured variables. On the second-order, the constructs have also achieved by the path relation from the construct to its dimensions strongly reflected and significant. Each path critical ratio (C.R) shows the standardized estimate is highly indicated of them.

The study is executed to test the theory of soft-TQM dimensions in the part of total quality management, where each measurement variable is confirmed and accumulated by its five items are valid. However, each dimension is generated a high value of regression except one dimension of employee relations, which is poor that is desirable in further analysis of the structural equation modeling (SEM). Moreover, the path relation between TQM with employee relations generated significant at the level of a critical ratio of 0.29. Nevertheless, each factor loading in the test of first-order and second-order confirmatory analysis is established to promote for the SEM analysis. Therefore, the study has confirmed the theory, which was early to connect the literature reviews of the soft total quality management dimensions. Yet, the study demonstrated the theory of empirical literature reviews has tested with the goodness of fit parameter indication. However, in the fits of incremental and absolute fit parameters are confirmed the measurement variables. Therefore, the study is accumulated the model estimation by the fit indications are achieved with cut-off points.

Subsequently, in this study, CFA analysis can lead the path regression analysis with testing the model relationship through structural equation model (SEM) analysis. However, there was a limitation in this study, which used only three dimensions of soft-TQM. Therefore, this study revealed that connecting with more dimensions in further analysis to test the theory with more soft dimensions.

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