Validating Measurement Model For Total Quality Management Practices On Optimization Of Service Organizations Using Confirmatory Factor Analysis

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Abstract— **Purpose of this paper is to detail a validation of measurement model for Total Quality Management (TQM) practices proposed to optimize services organizations performance outcomes, using Confirmatory Factor Analysis (CFA) method. The measurement model involved data collected from 209 services organizations in Malaysia. Data screening and reliability test were conducted and reported. CFA was applied through two stages, first run and second run, using AMOS ver.20 software. Results of the reliability analysis showed acceptable Cronbach's Alpha values (more than 0.7). Run-respecify-run procedure of CFA confirmed the measurement model to be utilized for further stages.**

Keywords: **TQM practices, Service organizations optimization, CFA, measurement model.**

I.   INTRODUCTION

Implementing Total Quality Management (TQM) optimizes overall services organizations outcomes through increasing their competitive advantage [1, 2]. However, the optimistic results of competitive advantage increase depends on how TQM has been implemented [3]. An argument placed on the ideal method to implement TQM system is integrating them into the everyday business practices of the firm. Besides, some elements of the management system of the firm such as top management knowledge of TQM that supports its implementation and practices human resource involvement in business processes, customer satisfaction, can play crucial role in successful implementation of TQM in optimization of services organizations results [4].

Lewis et al (2006) argument is supported by Abdullah, Uli, & Tari [5]. Abdullah et al., (2009) added soft TQM practices attribute to a set of practices they came out with from four excellence models of TQM awards (namely Malcolm Baldrige National Quality Award (MBNQA); European Foundation for Quality Management (EFQM; and Deming Award). Those practices include: organization's leadership practices, organizational learning practices, teamwork practices, process management practices, training and communication practices.

High market competition and the significant raise of services organizations contribution to local and global economics during the last two decades have increased the need for TQM in services industries [6-8]. Implementing TQM system in services organizations differs from implementing them in manufacturing organizations [6, 9, 10]. Manufacturing organizations emphasize on the product process management and quality, while service organizations focus more on human resource and customer satisfaction [11].

II.   LITERATURE REVIEW

TQM Practices

TQM Practices refer to group of activities and actions to manifest TQM principals [12]. TQM practices are excerpted from Quality Management QM practices which formulated and developed by quality management gurus, like Deming (1986) and Juran (1988), and late TQM pioneer authors' like [1, 13-15] who developed frameworks that have became basis of TQM practices literature and business excellence awards criteria like Baldrige National Quality Award (MBNQA), see table 1. However, most of developed TQM practices framework based on the manufacturing process and production quality. Significance of TQM practices in services industries increases in parallel with the increase of services industries role in the local and international economics [7, 8, 16].

Table 1: Comparing TQM practices between different studies

Powell (1995)	Motwani (2001)	Kaynak (2003)
Executive commitment	Top management commitment to TQM	Management leadership
Customer relationships	Customer involvement Customer satisfaction	
Supplier relationships	Vendor quality management	Supplier quality
Employee empowerment -Adoption and Communication	Employee empowerment	Employee relations

Process improvement		Process management
Flexible manufacturing		Quality system improvement
Zero defect and Measurement	Product design	
		Statistical quality techniques
Quality training	Employee training	Employee training
Benchmarking	Quality measurement and benchmarking	

Source: author

Training emphasizes is on interpersonal relationship and communication skills	Training emphasizes on technical skills
Checking customer feedback is important	Elimination of product defects is important
Quality measurement through customer satisfaction	Quality measurement by statistical techniques

Source: Lenka et al., (2010)

III. TQM PRACTICES IN SERVICE ORGANIZATIONS OPTIMIZATION

It is proved that implementing Total Quality Management (TQM) optimizes the performance of services organizations and increases their competitive advantage [1, 2]. The optimistic outcomes of TQM on the performance depends on the way of employing TQM [3]. The proper implementation of TQM system the proper results on performance. The optimistic implementation of TQM system is integrating them into the everyday business practices of the firm. Besides, some elements of the management system of the firm such as top management knowledge of TQM that supports its implementation and practices human resource involvement in business processes, customer satisfaction, can play crucial role in successful implementation of TQM in optimization of services organizations results [4].

Earlier evolution of TQM focused on manufacturing and production industries rather than service industries. The high competition in the market and the increase in service sector share in local and global economics increased the need for TQM in services industries [6-8]. Implementation approach of TQM in services organizations differs from its approach in manufacturing organizations [6, 9, 10]. Manufacturing organizations emphasize on the product process management and quality, while service organizations focus more on customer satisfaction [11]. Intangibility and heterogeneous of service nature compared to goods cause the big part this difference [10, 17]. The intangibility in service refers to the qualitative measurement that can not be presented in numbers [18, 19] which cause a measurement problem.

Service organizations use less hard practices of TQM practices, such as statistical process control SPC. They rely more on customers' judgment about services quality. In manufacturing organizations employee and workers trained on advanced statistical methods while in services organizations training focus on communication and interpersonal skills [20] , see table 2 .

Table 2: Comparing TQM practices between service and manufacturing organizations

TQM Practices in Service Organizations	TQM Practices in Manufacturing organizations
focus on Human resources	focus on technology and production
Management commitment and leadership is important	Management commitment and leadership is important.
Continuous improvement	Continuous improvement

Brah, Wong, & Rao [21] reported top management commitment, customer focus, employee empowerment, and employee involvement as the most critical TQM implementation constructs in service organization. Those constructs fit with the intangibility of service [21]. Samat, Ramayah, & Saad [22] added, in term of practices, to the previous constructs other three constructs: training and education, continuous improvement, and Information and communication. Comparing to the other discussed studies, TQM constructs used and examined in the study of Samat et al (2006) are more comprehensive. Besides, Samat et al' study was conducted in Malaysia where the current study takes place.

The same TQM constructs included in the framework of total service quality (TQS) developed by Gupta, McDaniel, & Herath [23]. Their framework included three leadership, organizational culture and employee commitment. Bon, Mustafa, & Rakiman [24] proposed three construct as the most dominant TQM constructs in service organizations: management leadership and commitment, customer focus, and human resource management.

Based on those discussed TQM constructs frameworks, the framework of this study includes six constructs to be validated in order to be used for further studies involve TQM constructs and practices. Those six constructs are: Management leadership commitment, customer focus, employee empowerment, employee involvement, training, and information analysis.

IV. METHODOLOGY

Data on TQM constructs (top management commitment, customer focus, employee empowerment, employee involvement, training, continuous improvement, and information analysis) was collected using both paper self delivered and online survey questionnaire method. The targeted respondents were top and senior managers, executives and heads of quality departments in services organizations that are ISO 9001: 2000, QMEA certified, any other local or international quality management and business excellence certification, and/or applied TQM and operate in Malaysia (both Malaysia's sides: Peninsular and Sabah and Sarawak states).

According to Malaysian Standard Industrial Classification (MSIC) 2008 Ver. 1.0 which followed the latest standards of International Standard Industrial Classification of All Economic Activities (ISIC), service sector in Malaysia comprises of 12 subsectors which are: Distributive trade, Food and beverage, Transport and storage, Health and social work, Information and Communication, Accommodation,

Business service, Financial service, Construction, Architectural, and related services, Education and training, Arts, entertainment and recreation, and Other services. Therefore, stratified random sampling technique was followed to select the sample [25, 26]. Each strata presented one subsector. A number of 680 questionnaires were distributed through both internet and self delivered survey methods. A total of 209 valid returned questionnaires were used in this study.

Based on the number of employees, the majority (91%) of the responded organizations was from small and medium sized enterprises (SMEs) and most of them implemented TQM systems for more than 10 years. Measurement items of the questionnaire were adapted from previous studies have the same purpose like this study, see table 6. All items were scaled 5-points likert scale, 1 presents strongly disagree, 2 presents Disagree, 3 presents inferential/normal, 4 presents Agree, and 5 presents Strongly agree. Slight changes and rewarding were done based on expert's opinion.

Table3:TQMconstructmeasurements

Construct	Number of Items	source
Top management Leadership	5	Kim, Kumar, & Kumar [27]; Leavengood & Anderson [28]
Customer Focus	5	Kim et al., [27]; Leavengood & Anderson [28]
Information & Analysis	5	Kim et al., [27]; Leavengood & Anderson [28]
Training	5	Kim et al (2012); Kaynak [1]
Continuous improvement	5	Sadikoglu & Zehir [29]
Employee involvement	5	Sadikoglu & Zehir [29]
Employee empowerment	5	Sadikoglu & Zehir [29]; Santos-Vijande & Álvarez-González [30]

Answers of the all collected valid questionnaires (209 copies) were assigned to numbers and entered into Statistical Package for the Social Sciences (SPSS) software as a part of the data process and analysis phase of the research [25, 26]. Then data screening was implemented in order to deal with outliers and missing data. Then each construct was modeled in graph using Analysis of Moment Structures (AMOS ver. 20) software in order to be validated using confirmatory factor analysis CFA.

V. CONFIRMATORY FACTOR ANALYSIS

CFA was considered to be proper validation method in this study because TQM constructs were already been empirically tested and existed in theoretical models of previous studies [31-33]. To validate a construct using CFA the construct must meet the good-of-fit indices values. Assessing the fitness of the construct indicates whether the construct fits the data or not [34, 35]. In applying CFA under structural equation modeling (SEM) approach , most of indices are categorized under two categories: absolute good-of-fit indices and incremental good-of-fit indices [34]. There are many indices show the good-of-fit such as Goodness-of-Fit Index (GFI) and Normed Fit Index (NFI), or Comparative Fit Index (CFI), nonormed fit index (NNFI), also named Tuker-Lewis Index (TLI), [34-36]. Marsh, Hau, & Grayson,

[32] indicated that the most of good-of-fit indices used are Chi-square statistic (x²), CFI, root mean square error of approximation (RMSEA), GFI, TLI and NFI. Accordingly, this study will use those indices. x² should be higher than .05. The acceptable values of GFI, TLI, and CFI is above .9 while the acceptable value of RMSEA is below .1 [33].

In addition to GOF, measurement model is also validated through factor loading (or regression weight in AMOS text output) and communality (or squared multiple correlation) values. In order to considered for further analysis, item should have factor loading value above .5 and communality above .4 [37].

First run of the measurement model

Figure 1 shows the first run of graphic measurement model for TQM constructs which are: Management leadership commitment (ML), customer focuses (CF), Employee empowerment (EE), Employee involvement (EI), training (TR), and information analysis (IA). Excluding GFI, all GOF indices in the figure show acceptable and good values (CHI-Square is significant 556.981, NC = 1.530, NFI = .919, TLI = .967, CFI = .970, RMSEA = .051). Factor loadings given by AMOS text output are listed in table 5 showing the item TR5 with poor loading (.338) and low communality value (.114). Therefore, the measurement model need respecification regarding the item TR5.

Model respecification performed through deletion or applying modification index that given by AMOS. Deletion recommended in case of poor factor loading (less than .5) or poor communality (less than .4) [33, 37]. Accordingly, in the case of item TR5 and item EI5 the better respecification procedure is the deletion.
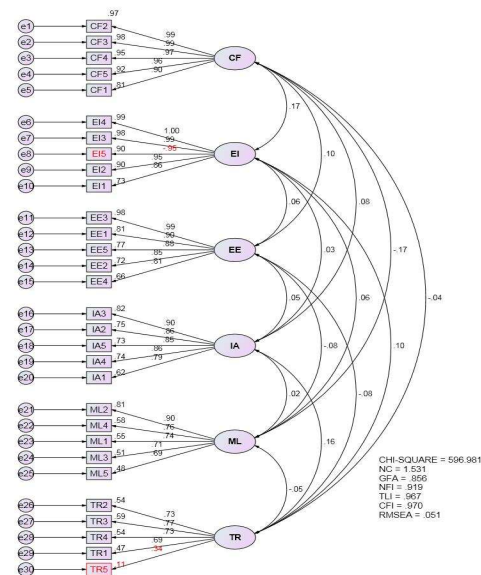

Figure 1: Measurement model (first run)

Table 4: factor loadings of the measurement model in the first run

Relationships			Factor loadings
CF2	<---	CF	.987
CF3	<---	CF	.988
CF4	<---	CF	.974
CF5	<---	CF	.959
CF1	<---	CF	.897
EI4	<---	EI	.995
EI3	<---	EI	.992
EI5	<---	EI	-.948
EI2	<---	EI	.947
EI1	<---	EI	.856
EE3	<---	EE	.992
EE1	<---	EE	.900
EE5	<---	EE	.876
EE2	<---	EE	.846
EE4	<---	EE	.810
IA3	<---	IA	.904
IA2	<---	IA	.863
IA5	<---	IA	.852
IA4	<---	IA	.859
IA1	<---	IA	.785
ML2	<---	ML	.903
ML4	<---	ML	.761
ML1	<---	ML	.744
ML3	<---	ML	.714
ML5	<---	ML	.693
TR2	<---	TR	.732
TR3	<---	TR	.766
TR4	<---	TR	.734
TR1	<---	TR	.688
TR5	<---	TR	.338

Figure 2: Measurement model (second run)

Table 5: Factor loadings of the measurement model in the second run

Relationship			Factor loading
CF2	<---	CF	.987
CF3	<---	CF	.988
CF4	<---	CF	.974
CF5	<---	CF	.959
CF1	<---	CF	.898
EI4	<---	EI	.988
EI3	<---	EI	1.000
EI2	<---	EI	.947
EI1	<---	EI	.830
EE3	<---	EE	.974
EE1	<---	EE	.915
EE5	<---	EE	.894
EE2	<---	EE	.857
EE4	<---	EE	.830
IA3	<---	IA	.904
IA2	<---	IA	.863
IA5	<---	IA	.852
IA4	<---	IA	.859
IA1	<---	IA	.785
ML2	<---	ML	.886
ML4	<---	ML	.764
ML1	<---	ML	.771
ML3	<---	ML	.709
ML5	<---	ML	.730
TR2	<---	TR	.731
TR3	<---	TR	.780
TR4	<---	TR	.730
TR1	<---	TR	.678

Also shows the item EI5 has negative loading (-95). Based on these poor factor loadings, table 4, and communality values and also based on the slight outlier covariances values, the

Second run of the measurement model

Figure 2 shows TQM constructs measurement model after deletion the items TR5 and EI5. Now all GOF indices were enhanced to good. CHI-Square is still significant 353.081, NC decreased to 1.073, GFI increased to .896 NFI increased to .948, TLI increased to .996, CFI increased to .996, RMSEA decreased to .019.

Factor loadings given by AMOS text output are listed in table 8 and 9 respectively are good. Based on these GOF, factor loadings, table 5, and communalities value, no more respecification needed.
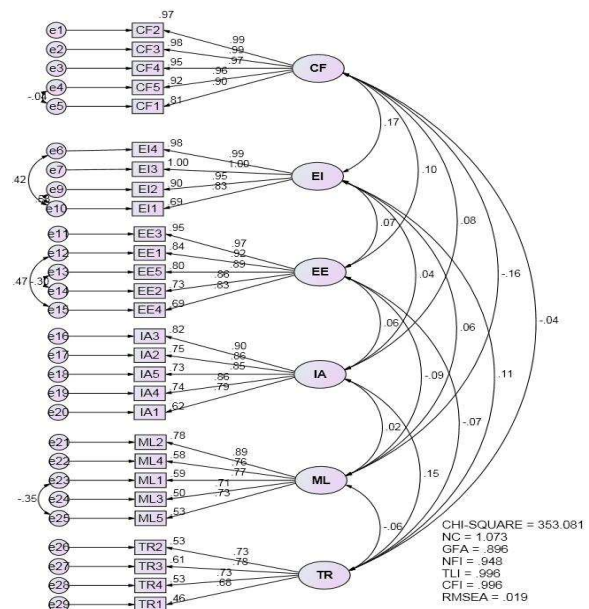
Assessing construct reliability and validity

Construct reliability is the internal consistency which measured by the squaring total sum of the factor loading, while Construct validity is "the extent to which a set of measured variables actually represent the theoretical latent that they design to measure". [33]. Construct validity is assessed through assessing four validity elements: convergent validity, discriminant validity, nomological validity, and face (or content) validity [25, 33, 35].

Assessing face validity

Face validity is "the agreement that a question, scale, or measure appears logically to reflect accurately what it was intended to measure" [25]. Face validity in this study was achieved through adapting all measures from previous studies conducted for the same purpose.

Assessing convergent validity

Convergent validity is referring to the degree of shared variance between measures of a construct [33, 34]. This validity is assessed though assessing construct loadings, Average Variance Extracted (AVE) and reliability of the construct. To achieve the convergent validity, factors loadings and AVE should be higher than .5 and construct reliability should be higher than .7, AVE less than .5 indicates error remains and it may be higher than the variance appears [33]. In this study, all factor loadings are above .5 as listed in table 11.

AVE is calculated by of sum of items squared factor loadings divided to the number of measures. The Formula for calculating AVE is:

$$VE = \sum_{i=1}^{n} \lambda_i^2$$

Where as:

i   presents number of items

λ   presents the standardized factor loadings

n   presents number of items of the construct

All constructs included in the model of this study achieved loadings factors and AVE above .5 and achieved good reliabilities (all above .8 except TRAINI is .79) as showed in table 4.29 for TQM constructs and table 4.30 for innovation constructs. Thus constructs convergent validity assumed to be achieved.

Table 6: Constructs AVE and items reliabilities

	CF	EI	EE	IA	ML	TR	Item Reliability	Delta
CF2	0.99						0.97	0.03
CF3	0.99						0.98	0.02
CF4	0.97						0.95	0.05
CF5	0.96						0.92	0.08
CF1	0.90						0.81	0.19
EI4		0.99					0.98	0.02
EI3		1.00					1.00	0.00
EI2		0.95					0.90	0.10
EI1		0.83					0.69	0.31
EE3			0.97				0.95	0.05
EE1			0.92				0.84	0.16
EE5			0.89				0.80	0.20
EE2			0.86				0.73	0.27
EE4			0.83				0.69	0.31
IA3				0.90			0.82	0.18
IA2				0.86			0.74	0.26
IA5				0.85			0.73	0.27
IA4				0.86			0.74	0.26
IA1				0.79			0.62	0.38
ML2					0.89		0.78	0.22
ML4					0.76		0.58	0.42
ML1					0.77		0.59	0.41
ML3					0.71		0.50	0.50
ML5					0.73		0.53	0.47
TR2						0.73	0.53	0.47
TR3						0.78	0.61	0.39
TR4						0.73	0.53	0.47
TR1						0.68	0.46	0.54
AVE	0.93	0.89	0.80	0.73	0.60	0.53		

VI. CONCLUSION

Purpose of this paper was to validate a measurement model for TQM constructs in service organizations using CFA method. The data was collected from 209 0rganizations from 12 services subsector namely (Distributive trade, Food and beverage, Transport and storage, Health and social work, Information and Communication, Accommodation, Business service, Financial service, Construction, Architectural, and related services, Education and training, Arts, entertainment and recreation, and Other services). CFA applied using AMOS ver.20. Assessment of the measurement model performed based on three justifiers: GOF indices, items loadings (factor loadings) values, and applying modification index. Based on CFA two-run stages, the measurement model was developed and considered valid for involving in further use.

VII.   ACKNOWLEDGEMENT

REFERENCE

[1]   Kaynak, H., The relationship between total quality management practices and their effects on firm performance. Journal of Operations Management, 2003. 21(4): p. 405-435.

[2]   Flynn, B.B., R.G. Schroeder, and S. Sakakibara, The Impact of Quality Management Practices on Performance and Competitive Advantage. Decision Sciences, 1995. 26(5): p. 659-691.

[3]   Soltani, E., et al., A review of the theory and practice of managing TQM: An integrative framework. Total Quality Management & Business Excellence, 2008. 19(5): p. 461-479.

[4]   Lewis, W.G., K.F. Pun, and T.R.M. Lalla, Exploring soft versus hard factors for TQM implementation in small and medium-sized enterprises. International Journal of Productivity and Performance Management, 2006. 55(7): p. 539 - 554.

[5]   Abdullah, M., J. Uli, and J. Tari, The relationship of performance with soft factors and quality improvement. Total Quality Management, 2009. 20: p. 735-748.

[6]   Juneja, D., S. Ahmad, and S. Kumar, Adaptability of Total Quality Management to Service Sector. International Journal of Computer Science & Management Studies, 2011. 11(2): p. 93-98.

[7]   Alejandro, L., et al., An Overview and Examination of the Malaysian Service Sector, O.O.I. U.S. INTERNATIONAL TRADE COMMISSION, Editor. 2010: WASHINGTON.

[8]   OECD, R&D and innovation in services. 2008, Directorate for Science Technology and Industry, Organization for Economic Co- operation and Development OECD.

[9]   Bon, A.T. and E.M.A. Mustafa, Impact of Total Quality Management on Innovation in Service Organizations: Literature Review and New Conceptual Framework. Procedia Engineering, 2013. 53(0): p. 516-529.

[10] Lenka, U. and D. Suar, A holistic model of total quality management in services. The Icfaian Journal of Management Research, 2008. 7(3): p. 57-72.

[11] Mustafa, E.M.A. and A.T. Bon. Impact of Customer orientation on Innovation: Literature Review. in National Graduate Conference 2012 (NatGrad2012). 2012. Putrajaya Universiti Tenaga Nasional.

[12] Rönnbäck, Å. and L. Witell, A review of empirical investigations comparing quality initiatives in manufacturing and service organizations. Managing Service Quality, 2008. 18(6): p. 577 – 593.

[13] Powell, T.C., Total quality management as competitive advantage: A review and empirical study. Strategic Management Journal, 1995. 16(1): p. 15-37.

[14] Motwani, J., Critical factors and performance measures of TQM. The TQM Magazine, 2001. 13(4): p. 292 - 300.

[15] Ahire, S., D. Golhar, and M. Waller, Development and Validation of TQM Implementation Constructs. Decision Sciences, 1996. 27(1): p. 23-56.

[16] Ueno, A., What are the fundamental features supporting service quality. Journal of Services Marketing, 2010. 24(1): p. 74 - 86.

[17] 17.   Talib, F., Z. Rahman, and M.N. Qureshi, Total Quality Management in Service Sector: A literature Review. International Journal of Business Innovation and Research, 2012. 6(3): p. 259- 301.

[18] Zeithaml, V.A., M.J. Bitner, and D.D. Gremler, Services marketing: integrating customer focus across the firm. 4 ed. 2006, Singapore: Mc-Graw hill.

[19] Parasuraman, A., V.A. Zeithaml, and B. L., Servqual: A multiple- item scale for measuring consumer perceptions of service quality. Journal of Retailing, 1988. 64(1): p. 12 - 40.

[20] Lenka, U., D. Suar, and P.K.J. Mohapatra, Soft and Hard Aspects of Quality Management Practices Influencing Service Quality and

Customer Satisfaction in Manufacturing-oriented Services. Global

Business Review, 2010. 11(1): p. 79-

101.

[21] Brah, S.A., J.L. Wong, and B.M. Rao, TQM and business performance in the service sector: a Singapore study. Intenational Journal of Operations and Production Management, 2000. 20(11): p. 1293-1312.

[22] Samat, N., T. Ramayah, and N.M. Saad, TQM practices, Service Quality, and Market Orientation: Some empirical Evidence from a Developing Country. Management Research News, 2006. 29(11): p. 713 – 728.

[23] Gupta, A., J.C. McDaniel, and S.K. Herath, Quality management in service firms: sustaining structures of total quality service. Managing Service Quality, 2005. 15(4): p. 389 - 402.

[24] Bon, A.T., E.M.A. Mustafa, and U.S. Rakiman. TOTAL QUALITY MANAGEMENT PRACTICES IN SERVICE ORGANIZATIONS IN MALAYSIA: A REVIEW. in International Conference of Technology Management, Business and Entrepreneurship 2012 (ICTMBE2012). 2012. Malacca: Universiti Tun Hussein Onn Malaysia

[25] Saunders, M., P. Lewis, and A. Thornhill, Research Methods for

Business Students. 5 ed. 2009, Harlow: Prentic

Hall.

[26] Zikmund, W.G., Business Research Method. 8 ed. 2003, Cincinnati: Thomson South-Western

[27] Kim, D.-Y., V. Kumar, and U. Kumar, Relationship between quality management practices and innovation. Journal of Operations Management, 2012. 30(4): p. 295-315.

[28] Leavengood, S. and T.R. Anderson. Best practices in quality management for innovation performance. in Technology Management in the Energy Smart World (PICMET), 2011

Proceedings of PICMET '11:.

2011.

[29] Sadikoglu, E. and C. Zehir, Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms. International Journal of Production Economics, 2010. 127(1): p. 13-26.

[30] Santos-Vijande, M.L. and L.I. Álvarez-González, Innovativeness

and organizational innovation in total quality oriented firms: The moderating role of market turbulence. Technovation, 2007. 27(9): p. 514-532.

[31] Hair, J.F., et al., Multivariate Data Analysis with Readings. 4 ed.

1995, Englewood Cliffs, NJ: Prentice

Hall.

[32] Marsh, H.W., K.T. Hau, and D. Grayson, Goodness of fit in structural equation models, in Contemporary psychometrics, A. Maydeu-Olivares and J.J. McArdle, Editors. 2005, Lawrence Erlbaum.: Mahwah, NJ. p. 275-340.

[33] Hair, J.F., et al., Multivariate Data Analysis: A Global Perspective.

7 ed. 2010, New Jersey: Pearson Education

Inc.

[34] Byrne, B.M., Structural Equation Modeling with AMOS:

Basic Concepts, Applications, and Programming. 2 ed. 2010, New York: Routledge.

[35] Kline, R.B., Principles and Practice of Structural Equation Modelling. 2 ed. 2005, New York: The Guilford Press.

[36] Anderson, J.C. and D.W. Gerbing, Structural equation modeling in practice: A review and recommended two-step approach. Psychological Bulletin, 1988. 103(3): p. 411-423.

[37] Awang, Z., Structural equation modeling using amos graphic. 2012, Shah Alam: UiTM Press.