USING STRUCTURAL EQUATION MODEL (SEM) AS TECHNIQUE TO EXAMINE MULTIPLE INTERRELATED DEPENDENCE RELATIONSHIPS TOTAL QUALITY MANAGEMENT(TQM) OF MALAYSIA HERBAL INDUSTRY

[1]MAZITA MOKHTAR, [2]WAN KHAIRUL ANUAR WAN ABD MANAN, [3]IDA RIZYANI TAHIR,[4]AZIZAN AZIT, [5]ROZITA MOKHTAR,[6] MUHAMMAD AIMAN ZULKIFLI, [7]MUHAMMAD BUKHORY SHAIDATUL KHAMDI

[1,2,3,4]Faculty of Industrial Management, UMP Malaysia,[5]Politeknik Sultan Haji Ahmad Shah, Malaysia
[6]School of Law,University of Leeds, United Kingdom,
[7]Faculty of Information Technology, UniversitiTeknologiPetronas, Malaysia
Email: [1,2,3,4]mazita@ump.edu.my, [5]rozita1803@gmail.com,[6]iman3010it@gmail.com,[7]bukhoryotai96@gmail.com

Abstract - This research applies a Theory of Quality Management (TQM) Underlying the Deming Management Method, by Anderson et al. (1994). As an effort to develop a flexible data collection tool, a questionnaire was developed for the respondents from herbal industry in Malaysia. The quantitative approach was used to measure the possible relationship among variables in the modification Deming model. The research data is collected via the survey method. Leedy and Ormrod (2005) stated that the goal of survey research is to learn information about a large population by surveying a sample of that population. The data and results of a quantitative approach can provide a general picture of the research problem (Creswell, 2005).To assess the factor structure of the scales and loadings of individual items on each scale, structural equation modelling was conducted using AMOS 18 (Arbuckle, 1999). Structural equation modelling (SEM) is a useful technique to examine multiple interrelated dependence relationships containing unobservable concepts (Hair et al., 2005; Byrne, 2010).

Keywords - Structure Equation Model(SEM),Malaysia Herbal Industry, Total Quality Management(TQM)

I. INTRODUCTION

The quantitative approach was used to measure the possible relationship among variables in modification deming model. The research data is collected via the survey method. Creswell (2003) defines a survey method as a "numeric description of trends, attitudes, or opinions of a population by studying a sample of the population.Leedy and Ormrod (2005) stated that the goal of survey research is to learn information about a large population by surveying a sample of that population. The present research will be conducted in survey method to examine the hypothesis and the model of job stress (de Vaus, 2001). The data and results of a quantitative approach can provide a general picture for the research problem (Creswell, 2005).

II. THE METHOD OF QUANTITAVE ANALYSIS

2.1. Strutural Equation Model

To assess the factor structure of the scales and loadings of individual items on each scale, structural equation modelling was conducted using AMOS 18 (Arbuckle, 1999). Structural equation modelling (SEM) is a useful technique to examine multiple interrelated dependence relationships containing unobservable concepts (Hair et al., 2005; Byrne, 2010). According to Byrne (2010) SEM is "a statistical methodology that takes a confirmatory approach to the multivariate analysis of a structural theory bearing on some phenomenon" (p.3).

Confirmatory factors analysis represents a deductive approach in that researchers employ a top-down approach by predicting an outcome from a theoretical framework. SEM is known as the second-generation statistical test, because it is designed to confirm a theory. The development and evaluation of a confirmatory analysis typically involve five steps (Hair et al., 2005; Byrne, 2001): (a) model specification, (b) model identification, (c) model estimation, (d) model evaluation, and (e) model respecification. Confirmatory factors analysis is known as theory-verification techniques, while exploratory factor analysis is known as theory-generating techniques (Stevens, 2002).

The advantage of SEM is that it is designed to evaluate how all proposed conceptual models that contains observed (items) and unobserved (construct) variables explain of fit the data. It also provides the ability to measure or specify the structural relationships among the sets of unobserved variables while describing the amount of unexplained variance (Byrne, 2001). In addition, SEM is suitable when testing models based on well-developed theories (Stevens, 2002), and using SEM, the simultaneous effect of the constructs can be estimated (Hair et al., 2005; Byrne, 2001). Therefore, SEM was adequate for testing the hypotheses and proposed relationships in the research model.

The maximum likelihood estimation method was utilized in this study. Maximum likelihood estimation is one of the most widely used, and it is efficient and unbiased when the assumption of multivariate normality is met (Hair et al., 2005). Therefore, multivariate normality should be tested before the SEM analysis. Multivariate normality can be assessed by skewness and kurtosis. Skewness refers to how uneven data are distributed or refers to the lack of symmetry in a frequency distribution. Distribution that had long "tail" to the right have a positive skew and those with long "tail" on the left have a negative skew. Kurtosis describes how "peak" or "flat" distribution is compared to normal distribution (Leech et al., 2008). Generally, the data is considered non-normal if skewness value shows over 2.0, and indicates kurtosis over 7.0 (Byrne, 2001). Curran et al., (1996) suggested value below >2.0 for skewness and >7.0 for kurtosis as the guidelines of severe normality.

In this study, a two-step modeling approach was adopted (Kline, 1998; Byrne, 2001). In the first step, a measurement model was tested to make sure that all latent constructs correlate with manifest variables. In step two, a structural analysis designed to test relationships among latent variables was examined. These relationships among variable will be tested only after ensuring that latent variables have been measured adequately. This procedure will reduce the risk of misinterpretation and bias (Anderson and Gerbing, 1988).

Besides, the criterion of model fit is very important in SEM. Model fit's indices signify the degree to which the observed variables represent the construct in the model. Previous studies suggested three types of model fit measurers: absolute, incremental, and parsimonious fit indices, but there is no single recommended measure of fit indices (Hair et al., 2005; Byrne, 2001; Meyers et al., 2006). To examine the overall model fit, the squared error of approximation (RMSEA), chi-square/degree of freedom (CMIN/DF), Tucker-Lewis index (TLI), the goodness of fit index (GFI), the adjusted goodness of fit index (AGFI), the comparative fir index (CFI) and normed fit index (NFI) will be used. Chi-square is an absolute measure of model fit, with small value of chi-square indicating a good fit. That means, significance levels for chi-square greater than .05 are desirable. Satisfactory model fit is indicated by RMSEA values less than or equal to .08 it represent reasonable, and value ranging from .08 to .10 indicate mediocre, while a value below .05 indicates very good fit to model. GFI and CFI are recommended over .90, and values greater than .08 are indicative of good fit for AGFI. The PGFI with higher value (closed to 1) indicates a more fit (Byrne, 2001). The TLI and NFI values greater than or equal to .90. Moreover, CMIN/DF values less than or equal to 5.0 is adequately reasonable for a model (Byrne, 2001; Meyers et al., 2006). After we tested the measurement model and confirmed the satisfactory result, then the structural model of the relationship between exogenous variables with endogenous variables was tested.

III. RELIABILITY AND VALIDITY METHOD

The questionnaire was analyzed to test the reliability and validity of a questionnaire, before the research questionnaire is used to get the data. The aim of this step is to ensure that the data received is valid and reliable. Validity itself is derived from the word "valid," which means how far the accuracy of the questionnaire and the accuracy of the measuring instrument in the measuring function. An instrument is said to have a good validity if the instrument accurately measures what is supposed to measure, and has a precision in every detail to describe the differences among subjects with one another (Hair et al., 2005; Leech et al., 2008).

Reliability refers to how consistent an instrument measures is supposed to measure. In other words, the measurement results could be trusted in terms of the score consistency obtained from a similar sample. The internal consistency approach was used to test the reliability of the instruments (Hair et al., 2005; Leech et al., 2008).

In this research, researcher makes two analysis steps for examining the questionnaire. First, the reliability of a questionnaire will be analyzed by internal consistency method using Cronbach's alpha statistical method. The internal consistency method is known as single trial administration that examines a consistency between dimensions or between an item of a questionnaire. If the score of scale has a stability between item or dimension, it means that the scale has a consistency or reliable as a measurement tool (Hair et al., 2005; Leech et al., 2008).

The validity of a questionnaire in this research in the first step will use content validity method by using professional judgment that asses the face and logic validity of scale. The qualitative analysis is used in assessing content validity based on analysing the content of scale, whether correctly and logically represent the indicator of variables. After assessing the content validity, the validity of a questionnaire will be analyzed using a statistical method by testing the correlation item-total score to make sure that the questionnaire test what is intended wanted to test. Then exploratory factor analyses were used to examine the construct validity of a questionnaire, in order to test whether the items appropriately measure the theoretical construct of variables. All data in the first step analyzed by using Statistical Package for the Social Sciences (SPSS) 15 for windows (Hair et al., 2005; Leech et al.,2008).

Then in the second step, researcher uses a confirmatory factor analysis method to find the reliability and validity of a questionnaire. Confirmatory factor analysis test and examine to underlying construct in manifest variables, whether represent the latent variable correctly and whether the model of data measurement fits empirically (Byrne, 2001; Meyers et al., 2006). Confirmatory factor analysis based on structural equation modeling method (SEM) that will be examined using Amos 18 statistical program. The final goal of this two-step analysis is to reachs the highest reliability and validity score of a questionnaire in order to get the reliable and valid data.

3.1. The Result of Questionnaire Reliability

The reliability coefficient alpha of each scale from sample is as follows: Visionary leadership (α = .794) with no dropped item. Internal external cooperation (α = .733) with one dropped item, because it has a lower item-total correlation score. Learning organization (α = .700) with three dropped items. Process management (α = .871) with no dropped item. Continuous improvement (α = .682) with one dropped item. Employee fulfillment (α = .738) with two dropped items. Customer satisfaction (α = .643) with two dropped items. Quality maintainance (α = .797) with no dropped item, and Quality improvement (α = .865) with two dropped items. Table 1 shows the coefficient alpha Cronbach for all questionnaires.

Table 1: Reliability Coefficient Alpha of instruments from sample.

Questionnaire	Cronbach' Alpha score
Visionary leadership	.794
Internal external cooperation	.733
Learning organization	.700
Process management	.871
Continuous improvement	.682
Employee fulfillment	.738
Customer satisfaction	.643
Quality maintenance	.797
Quality improvement	.865

Several items belonging to internal external cooperation, learning organization, continuous improvement, employee fulfillment, customer satisfaction and quality improvement were dropped because it has low item-total correlation score. These items should be dropped because it will decrease the overal reliability of the instrument. Cronbach (1970) stated that a conservative threshold of .30 as good item-total correlation score to be included in the battery of questionanire.

In Malaysian sample, internal external cooperation scale has one dropped item (item1 = .001) because it has lower item-total correlation score. Learning organization has three dropped items (item1= .022; item2= .244; item3= .190). Continuous improvement has one dropped item (item3= .191). Employee fulfillment has two dropped items (item5= .154; item6= .075). Customer satisfaction has one dropped items (item1= .019), and quality improvement scale has two dropped items (item1= .084; item2= .325). All dropped items will not be included in futher confirmatory factor analysis (CFA).

Table 2: The dropped items and Item-total correlation score of instrument from two samples.

Malaysian	
Instrument	***Item-totalcorrelation***
Internal external cooperation scale	.001
Item1	
Learning organization	.022
Item1	.244
Item2	.190
Item3	
Continuous improvement	.191
Item 3	
Employee fulfillment	.154
Item5	.075
Item6	
Customer satisfaction	.019
Item1	
Quality improvement	.084
Item1	.325
Item2	

IV. CONFIRMATORY FACTOR ANALYSIS OF MEASUREMENT MODEL

4.1 Measurement Model of Malaysian Sample

To test the measurement model, structural equation modeling was used by using AMOS 18. All data sets from two countries were analyzed independently. The measurement model, also called confirmatory factor analysis (CFA), specifies how well the observed variables related to a set of latent variables (Joreskog and Sorbom, 1993). All measurement models in this study were developed based on the theoretical and empirical reviews. Researcher used CFA to verify the loading of each item and specify the linkages between factors and items used to measure each factor (latent variables). If the goodness of fit measures for the measurement model are acceptable, it can be concluded that the items adequately measure the intended constructs.

Visionary leadership scale. To asses the factor structure of the scale and loadings of individual items on visionary leadership scale, a set of CFA tests were conducted. According to the previous reliability test by using internal consistency method, the scale had no dropped item. After the model was re-estimated and the solution estimates were re-examined, the final model exhibited adequate goodness of fit statistics with acceptable factor loading levels.

Table. 3: CFA results for visionary leadership scale in Malaysian sample

Items	Standardized Factor Loadings	t-Values (C.R)	Skewness	Kurtosis
Item1	.753	8.971	1.355	2747
Item2	.632	7.183	.840	1135
Item3	.786	8.649	.820	630
Item4	.572	6.517	.648	357
Item5	.634	7.177	.857	799
Item6	.581	6.569	.886	1.946
Fit measurement	Chi-square= 1.692 df=8 CMIN= .212, p=.989>.001	RMSEA =.000 TLI= 1.038	NFI= 995 GFI= .996	CFI= 1.00 *p<.001
Items reliability	Item1= .566; Item2= .399; Item3=.618; Item4=.327; Item5=.402; Item6= .338			

Table 3 shows the CFA model fits, factor loading of items, and t-values for path coefficient. It also describes skewness and kurtosis values for the multivariable normality. The t-values were significant at level of .05, and the values of skewness and kurtosis were not exceeded recommended values (2.0 and 6.0, respectively), than the scale has a normal distribution. The chi-square is reasonably fit (1.692, (8), p>.01, CMIN= .212), RMSEA= .000, TLI=1.038, GFI= .996, NFI=.995, the t-values of each items are significant (p<.01), and other model fits showed strong values for well-fitting model. thus, the CFA results showed that the model is a good one with solid path coefficients.

CONCLUSIONS

This study used the Statistical Package of Social Science (SPSS) version 21.0to analyze the first phase data. According to Hair et al.(2011),in the first phase, SPSS software is used for data screening, coding and detecting others and normality, whereas in the second phase structural model for hyphothesistesting isperformed. In second stage, CFA was performed for SEM in order to test the research hypotheses.Previous studies claimed SEM is more reliable and valid for social sciences study and it also shows from this study

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In National Agricultural Policy of herbal products, it was classified under the specific product(Specialty product)(MOA,1999). To ensure this productis benefitted around the world, a product of herbal ingredients can be exported under the classification of Food biotech or Agro biotech Nuraceuticals(MOA,1999).

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