Value-Based Performance Excellence Model for Higher Education Institutions in Malaysia: On Bayesian Structural Equation Modeling

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ABSTRACT

Nowadays, universities throughout the world are striving hard to demonstrate their commitment to academic excellence, research, and professional services. In addition, they are determined to show their accountability by establishing the impact of their performance on the community, nation, and world. The common measures of academic performance of universities such as number of students enrolled in academic programmes, number of research publications, amount of research funding etc. are tangible and quantitative in nature. It should be noted, however, that intangible or qualitative measures such as students' satisfaction with academic programmes and reputation of a university are examples of equally important yardsticks of academic performance. Other intangible academic performance indicators of universities should also include those yardsticks that are related to core values. For instance, 'plagiarism' in academic works is an example of a value-based indicator that reflects some departure from the core value of 'academic integrity'. Therefore, the aim of this article is to empirically test a theoretical model of Value-based Performance Excellence indicators for Higher Education Institutions (IHLs) in Malaysia. A sample of 419 respondents from eleven Malaysian Public Universities was collected and the data were analysed to validate the model. Structural Equation Modeling (SEM) through Bayesian estimation was used in the analysis. The results of analysis showed the estimation using Bayesian estimation is comparatively close to maximum likelihood estimation. Therefore, the model is statistically valid and reliable.

Keywords: *intangibles, core values, value-based performance excellence model, maximum likelihood, Bayesian estimation.*

Introduction

Measuring tangible things like return on investment (ROI), cash flow, revenues and profitability are no longer the yardstick for performance measurement of an organisation. It has revolutionised towards measuring the intangibles that includes quality, customer satisfaction, safety and core values (Mokhtar et al., 2008). In Higher Education Institutions (HEIs) such as universities are also striving hard to demonstrate their commitment to academic excellence, research, and professional services. They are to show their accountability through their performance on the community, nation, and world. Previously, the common measures of university's performance indicated by the number of students enrolled, quantity of research publications, amount of research funding etc. All of these performance

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indicators are tangible and quantitative in nature. Nevertheless, the intangible or qualitative measures such as students' satisfaction with academic programmes, reputation of a university are among of equally important yardsticks of a university performance. Henceforth, other intangible indicators of universities are related to core values that contribute to the excellence of HEI. For instance, 'plagiarism' in academic works is an example of a value-based indicator that reflects some departure from the core value of 'academic integrity. Therefore, core values are said to be the intangible indicators and the inner drive for leading the university towards excellence.

This article is part of a study of Value-Based Performance Excellence Model for HEIs in Malaysia that focuses on the inter-relationships among strategic drivers of performance excellence through core values. The model was tested using the maximum likelihood (ML) estimation and Partial Least Squares (PLS) estimation (Ab Hamid et al., 2012; 2011a, b). Therefore, the aim of this article is to empirically cross-validate the theoretical model of Value-based Performance Excellence Model for HEIs (Figure 1) through Bayesian Structural Equation Modeling.

Hypothesised Structural Model

Leadership, cultures, productivity, employees, stakeholders and university performance results are interrelated and crucial to the performance of organisations (Mokhtar et al., 2012). Many studies focused on these criteria signifying its importance. Figure 1 depicts the research model employed in this study. The leadership values are distinct factors that influence the culture values, productivity values, employee values and stakeholder values, while culture values is hypothesized to influence productivity values, employee values and stakeholder values. Also, employee values are hypothesized to influence productivity values, and stakeholder values. In addition, the three factors of productivity values, employee values and stakeholder values are hypothesized to impact the university performance. Readers are referred to Mokhtar et al. (2012, 2011) and Ab Hamid et al. (2012; 2011a, b) for further explanation on the theoretical framework of Values Based Performance Excellence Model for HEIs in Malaysia.

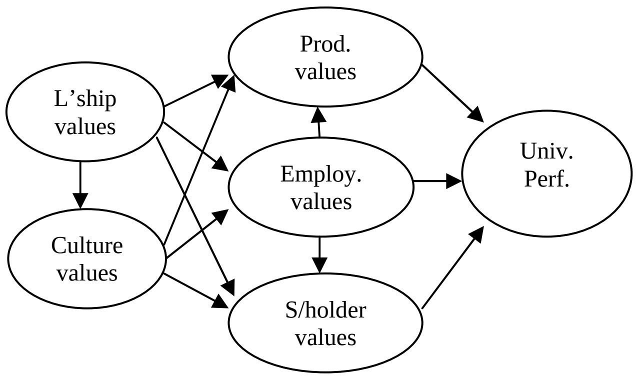


Figure 1: Hypothesised Model of Value-Based Performance Excellence Model for Malaysian Universites (Ab Hamid et al. 2012, 2011a, 2011b)

Maximum Likelihood (ML) estimation

Before performing a Bayesian analysis of the hypothesised model, ML analysis is performed beforehand. Fundamentally, hypothesised model needs to achieve a good-fitting model before proceeding for Bayesian analysis for comparison purposes. The number of samples used in this study is 275 samples instead of 429 after taking into consideration the deletion of multivariate outliers in the dataset. Thus, the fit statistics results of SEM through ML are as follows.

Table 1: Fit statistics for structural model (n = 275)

Statistics	Value
Absolute Fit Indices	
Chi-square	1307.132
p-value	P<0.001
df	576
RMSEA	0.068
Incremental Fit Indices	
Comparative Fit Index (CFI)	0.954
Tucker-Lewis Index (TLI)	0.949
Parsimony Fit Index	
Normed Chi-Square (cmin/df)	2.269

From Table 1, it revealed that the fit statistics of the hypothesised structural model that is admissible. The unstandardised regression weights for each relationship in the hypothesised model are shown in Table 2. In the next section, Bayesian estimation is used for cross-validation in order to enhance the statistical value of the model.

Bayesian Estimation

Bayesian estimation was suggested by Arbuckle (2009) and Byrne (2010) for cross-validation of the results through ML estimation. It is an added advantage for the researcher to conduct analysis based on both methodological approaches and then conduct the comparative analysis for the parameter estimates (Byrne, 2010).

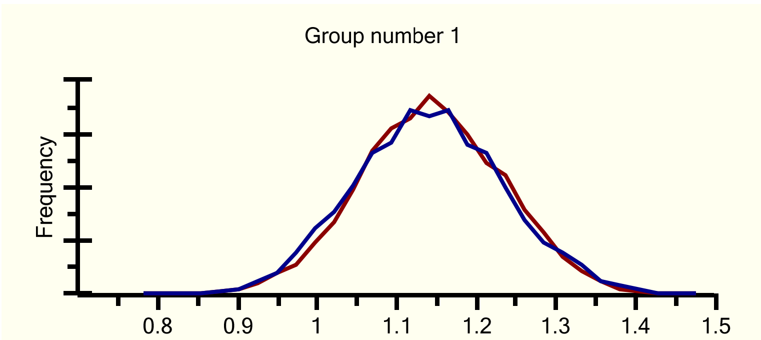
Basically, the fundamental concept in ML estimation, the true values of the model parameters are fixed but unknown, while the estimates from a given sample are considered to be random but known (Byrne, 2010; Arbuckle, 2009). Bayesian estimation works in a situation whereby any unknown quantity as a random variable and assign a probability distribution to it (Byrne 2010). In another words, in Bayesian estimation, the true model parameters are unkown and considered to be random. The parameters are assigned a joint distribution i.e. prior distribution (before the data are observed) and posterior distribution (after being observed) which will be combined together. This joint distribution is based on the formula which is called as Bayes' theorem. There are two important elements of the joint distribution which are the mean of the posterior distribution as the parameter estimate and also the standard deviation of posterior distribution that serves an analog to the standard error in ML estimation (Byrne, 2010).

The Bayesian SEM analysis was conducted using AMOS 18.0 software to estimate the unstandardised weights produced by this analysis with the unstandardised loading obtained in the analysis using ML procedure. The prior distribution used in this study is non-informative or diffuse prior distribution. It is because it offers only little information as it spreads its probability over a very range of parameter values. Arbuckle (2009) stated that AMOS applies a uniform distribution in the range of $\pm 3.4 \times 10^{-28}$ to each parameter by default. The results of the comparative analysis are shown in Table 2.

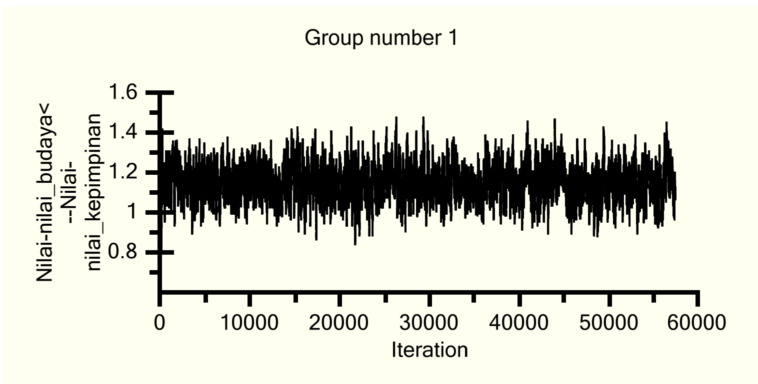
Table 2: Comparative Analysis (Maximum Likelihood (ML) and Bayesian Estimation)

Causal Relationships	**Estimation**	
	ML	**Bayesian**
Leadership values > culture values	1.135	1.153
Leadership values > productivity values	0.023	0.022
Leadership values > employee values	0.301	0.308
Leadersh. values > stakeholder values	0.153	0.152
Culture values > productivity values	0.131	0.130
Culture values > employee values	0.739	0.738
Culture values > stakeholder values	0.035	0.037
Productivity values > University Performance	0.392	0.392
Employee values > productivity values	0.629	0.636
Employee values > stakeholder values	0.803	0.811
Employ. values > University Performance	0.023	0.027
Stakeholder values > University Performance	0.508	0.506

The result in Table 2 is the comparison between the unstandardised factor loading estimates for the ML method versus Bayesian posterior distribution estimates. We can observe that only a small difference exist between the loadings generated from ML estimation and Bayesian estimation. Also, the results of Bayesian SEM could be based on diagnostics plots obtained from the output. One example of the relationship of leadership values on culture values are shown in Figure 2 below.



(a) Diagnostics plots of *first and last combined polygon* Bayesian SEM for leadership values on culture values



(b) Diagnostics plots of *trace* Bayesian SEM for leadership values on culture values

Figure 2: Diagnostics plots of Bayesian SEM for the relationship of leadership values on culture values

From the display in Figure 2(a) we observed that the two distributions are almost identical, thereby suggesting that AMOS has successfully identified important features of the posterior distribution (Arbuckle 2009; Byrne 2010) of leadership values on culture values. In addition, the trace plot shown in (b) also called as time-series plot help us to evaluate how quickly the MCMC sampling procedure converged in the posterior distribution. Based on this, it can be considered to be very good as it exhibits rapid up and down variation with no long term trends (Arbuckle 2009;Byrne 2010). Thus, it indicates that the convergence in distribution occurred rapidly which give a clear indication that the SEM model was specified correctly (Arbuckle 2009; Byrne 2010).

Conclusions

In short, based on the review of the diagnostics plots, these estimates are very close pertinent to first and second order factor loadings. This gives evidence that the SEM using ML estimation in this study is acceptable since the model fits the data. In another words, the findings speak well for the validity (Byrne 2010) of the hypothesised model. Again through Bayesian SEM, this study offered evidence that the structural model did generate the data collected from the university's staff in HEI of Malaysia. This gives evidence that the path coefficient in the structural model or in the full-fledged SEM using ML estimation in this study is acceptable and reliable albeit the small sample size.

In this study, the hypothesized structural model model fits the sample data fairly well. In other words, there is no proof that the model is incorrect (Nordin, 2011). This is important if an organisation wants to be institutionalized it must be infused with values (Mokhtar et al. 2011; Collins & Porras 1996; Selznick 1957). Caveats should also be taken when interpreting the results of this study since the sample size of this study is very small. However, by using bootsrapping method in SEM, this study could possibly be well generalised to all the population of university staff in Malaysia. Furthermore, since all universities in Malaysia are placed under one ministry so that there is not much different between the employess in each university (Nur Riza 2008). Since, this study is conducted in Malaysia and possibly the values could also be extended to other types of organisation and not only in higher education sector but also service and public sector etc.

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