Journal of Theoretical and Applied Information Technology
15th December 2016. Vol.94. No.1

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

INTEGRATION OF EFQM EXCELLENCE MODEL AND INFORMATION SYSTEMS CRITERION

[1]ROSLI ISMAIL, [2]MASRAH AZRIFAH AZMI MURAD, [3]MARZANAH A. JABAR, [4]ROZI NOR HAIZAN NOR, [5]NORWATI MUSTAPHA,

[1,2,3,4,5] Faculty of Computer Science and Information Technology, Universiti Putra Malaysia, Serdang, 43400, Malaysia

E-mail: [1]roslibi@yahoo.com, [2]masrah@upm.edu.my, [3]marzanah@upm.edu.my, [4]rozinor@upm.edu.my, [5]norwati@upm.edu.my

ABSTRACT

Higher Education Institutions (HEIs) have become key institutions in the knowledge-based economy. Over the past decade, the Malaysian government has placed greater emphasis on improved efficiency and productivity in the HEI as an engine for promoting quality human capital for a knowledge-based economy. Importantly, the government raised the share of research and development in GDP from 1.5% in the Eighth Malaysia Plan (2000–2005) to 4.9% in the Ninth Malaysia Plan (2006–2010) for HEIs. As a result, there is a need to monitor the quality performance of HEIs to see if the government's objectives are being met. The European Foundation for Quality Management (EFQM) excellence model was introduced at the beginning of 1992 as the framework for assessing organizations for the European Quality Award. In fact, this model has been claimed to be the most widely used model of the national excellence awards in the European countries. However, it does not have Information Systems (IS) as a single criterion. The purpose of this paper is to evaluate the interrelationships between the EFQM excellence model and information systems criterion of Malcolm Baldrige National Quality Award (MBNQA) model in the HEIs of Malaysia. The paper identified ten (10) criteria from the research model: leadership; policy and strategy; people; partnership and resources; information systems; processes; people results; student results; society results and key performance results. We obtained 118 valid responses from person in charge of quality management in Malaysian HEIs. Structural equation model (SEM) is used to analyse the data and results indicate that the relationships among the research model followed the Information Systems-Quality Management theory and TQM theory.

Keywords: *EFQM, MBNQA, Quality model, Information systems*

1. INTRODUCTION

As prime producers of knowledge, Higher Education Institutions (HEIs) have become key institutions in the knowledge-based economy [1]. The HEIs in Malaysia are the main drivers of the knowledge economy and the main producers of quality human capital. Over the past decade, the Malaysian government has placed greater emphasis on improved efficiency and productivity in the HEI as an engine for promoting quality human capital for a knowledge-based economy[2]. Importantly, the government raised the share of research and development in GDP from 1.5% in the Eighth Malaysia Plan (2000–2005) to 4.9% in the Ninth Malaysia Plan (2006–2010) for HEIs [3]. As a result, there is a need to monitor the quality performance of HEIs to see if the government's objectives are being met [4].

In Europe, one of the most comprehensive model that is used in many European countries is EFQM excellence model [5], [6], however, it does not have Information Systems (IS) as a single criterion [5] and it places more emphasis on the role of processes and results [7]. On the other hand, IS has emerged as second importance factor after leadership in Malcolm Baldrige National Quality Award (MBNQA) model [8]–[10], the focus of MBNQA is on a single type of result but with emphasis on the IS [11].

Quality management (QM) has been widely studied by examining quality models and also various case studies in public organizations and large companies, but quality management in

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

HEIs has received far less attention [12]. Authors such as Gulbro et al. [13] believed that there are differences between the implementation of a quality model in large organizations and small organizations. Moreover, these differences are apparent in the implementation of the excellence model. For instance, according to Dewhurst et al. [14], some aspects of the quality model are emphasized differently in large companies and public organizations compared to the small organizations. Similarly, according to Eskildsen et al. [15], the focus on the EFQM criteria differs between large organizations and small organizations. It is necessary to perform more empirical research to explore more deeply the links between the agents that compose the quality model and the results [16], [17]. All these indicate that the knowledge of causal structure, importance, effects as well as achievable of criteria cannot be adequately provided for HEIs by merely relying on the studies which have been conducted in different sectors. Thus, this study will evaluate the interrelationships between the EFQM excellence model and the information systems criterion of MBNQA model in Malaysian HEIs.

2. LITERATURE REVIEW

2.1 The MBNQA Model

The MBNQA was established in 1987 in response to intense competition from Japanese companies. On August 20, 1987, Public Law 100-107 established the Baldrige Award criteria, basing the framework on the work of Malcolm Baldrige, Secretary of Commerce from 1981 until his tragic death in 1987. The United States National Institute of Standards and Technology (NIST) is the organization that manages the award program and administers the criteria, which as of 1999 includes categories for education, health care, services, and non-profit organizations [18], [19]. The criteria cover in MBNQA are leadership, strategic planning, student, stakeholder and market focus, measurement, analysis and knowledge management, workforce focus, process management and results[19].

Measurement, analysis, and knowledge management is information systems criterion and the fourth of seven criteria comprising the MBNQA model for performance excellence [19], [20]. Arif [21] stated that this criterion is the backbone of the whole MBNQA model. As an essential element of the MBNQA model, Jack et al. [22] noted "the information systems criterion focuses on how the organization selects, manages, and uses information and data to support key company processes, and improve company performance".

2.2 The EFQM Excellence Model

The success of the MBNQA model (USA) and the Deming prize (Japan) encouraged the formation of the European Foundation for Quality Management (EFQM) in 1988 [23]. The EFQM excellence model, previously called the European Model for Business Excellence, was introduced in 1991 with the European Quality Award being awarded for the first time in 1992 [23]. The model, which recognizes many approaches to achieving sustainable excellence in all aspects of performance, is based on the premise that: Excellent results with respect to Performance, Customers, People and Society are achieved through Leadership driving Policy and Strategy, People, Partnerships, Resources, and Processes [24].

2.3 Comparison of the Excellence Awards

According to Mavroidis et al. [6], EFQM excellence model, MBNQA model and Deming Prize are the most important excellence awards. The researchers further indicated that the majority of the countries all over the world have modelled their excellence awards based on these three awards so as to stimulate systematic quality improvement. In fact, the EFQM excellence model has been claimed to be the most widespread model of the national excellence awards in the European countries.

Miguel [25] compared the description of the quality awards presenting their objectives, and indicated that the Deming Prize emphasizes on the amendment of performance by applying company-wide control processes (CWQC) methods compared to EFQM and MBNQA which encourage and recognize the development of effective total quality management by implementing the principles and components of quality management in all aspects of the operations. Hence, it seems that EFQM and MBNQA provide a better representation of the TQM theory than the Deming prize. Besides, the researcher also highlighted a few differences between the criteria of the EFQM and MBNQA models. Saunders et al. [26] supported this

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

finding and justified two excellence models for the TQM theory which have been widely adopted all over the world, they are MBNQA and EFQM excellence models.

Sharma and Kodali [27] discussed 19 excellence awards around the world, and MBNQA, EFQM, and Deming Prize were indicated as the best-known and original excellence awards. Many excellence awards are derived from these three main awards with some modification of elements. Bou-Llusar et al. [28] also stated that EFQM excellence model and MBNQA model representing the core concepts of TQM. These models have five (5) similar criteria which are leadership, policy and strategy, people, processes and key performance results, and EFQM excellence model has four (4) additional criteria which are partnership and resources, customer results, people result and society results, meanwhile MBNQA has two (2) additional criteria which are customer and market focus and measurement, analysis and knowledge management.

2.4 Theory of the TQM Model

Winn and Cameron [29] indicated that the TQM model is based on the "Leadership drives the system which creates results" theory. According to [29], this theory attempts to categorize the core variables of TQM and explains the relationships between the categories. The theory consists of three major components, namely driver, system and results. The theory illustrates leadership dimension is the only driver in the TQM with a direct positive effect on the system dimensions. In addition, the theory explains leadership (Driver) does not directly influence result dimensions. Further, theory emphasizes the direct positive impact of system on the result dimensions. According to this theory, all models, which are developed based on the TQM, follow this logic. The researchers empirically tested the causal links between the three components of the theory. Their results confirmed the assumptions of the theory.

Wilson and Collier [10] stated that the Leadership drives the system which creates results theory poses the overall performance relationships in TQM model is recursive. In particular, the theory indicates the TQM model, as a recursive causal model, that is a system of equations that contain no reciprocal causation (two headed arrows) or feedback (circular) loop. The researcher attempted to test the theory empirically in the manufacturing companies in US, and the results supported the leadership drives strategic planning, information, human resources, customer focus and process which creates results theory.

Pannirselvam and Ferguson [30] found that the core concepts embodied by the TQM model could be categorized by three basic elements namely, driver, system, and results. In addition, the researchers also empirically examined the theory using the data derived from Arizona Governor's Quality Award and the results supported the theory. The study by Flynn and Saladin [9] supported the finding of the above research by indicating that leadership, as the only driver, has a direct positive effect on the system which consists of policy, information, people, customer focus and process in the MBNQA model.

According to Badri et al. [31], leadership is also the only exogenous variable which influences endogenous factors, including Strategic planning, Information, Human resources, Customer focus and Process directly and Results variables indirectly. In their study, the theory was tested using the MBNQA model as the TQM model in United Arab Emirates (UAE) universities. As a result, the empirical findings supported the theory.

Conti [32] reviewed the EFQM excellence model, and highlighted that the important differences between the EFQM and MBNQA models were the subdivision of EFQM model at the first level of criteria between "enablers" and "results". Just like the MBNQA model, the researcher justified that the cause-effect relationships between the EFQM excellence model was according to the general theory of the TQM model, Leaderships drives the system which creates results.

Sadeh et al. [33] examined the paths between the criterion of IS on the EFQM excellence model. The model not only explains interrelationships among EFQM criteria, but also illustrates the contributory impacts of IS on the EFQM criteria. Results indicate that interrelationships among excellence factors follow the assumptions of the EFQM excellence model. Also, data accentuate the supportive

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

effects of IS on different dimensions of the EFQM excellence model.

Calvo-Mora et al. [34] conducted a study to test the EFQM model in Spanish higher education sector, and considered some hypotheses to test the relationships between the EFQM criteria. The hypotheses were leadership positively impact people, policy and strategy, as well as partnerships and resources; policy and strategy positively impact people, partnerships and resources, and processes; people positively influence processes; partnership and resources positively influence processes; process management positively influence the results for students, people, and the centre; people results positively influence the results for the centre and students; student results positively influence the centre results; and centre results positively influence social results. In their research, students can be considered as the university's customers and the achievable results of the education centre are as the key performance results.

2.5 Information Systems and Quality Management (IS-QM) Theory

The contribution of IS to QM only give very little attention even it had been widely studied up to 1990s [35]. According to Tang et al., [36] from early 1990's, several countries and quality foundations have focused on the need of organizations, specially manufacturing firms, to apply IS effectively in QM.

Forza [35] developed a theory on the role of IS within QM (IS-QM theory). The IS-QM theory explains the support (causal positive effects) of IS to the practices of QM in achieving good quality performance. In particular, this theory provides a reference model to study the role of IS, including Quality Information Flows and IT for quality, in supporting QM. Afterwards, the idea of the theory was noticed and completed by the work of other scholars, such as Dewhurst et al. [37], Dewhurst et al [38]. Hemsworth et al. [39], Martínez-Lorente et al. [40], Sánchez-Rodríguez et al. [41] and Ismail et al. [42]. Subsequently, the support of IS to QM was examined and approved by several authors either partially or in full. Then, the idea of the theory has been agreed by the authors, i.e. integrating IS can improve QM especially for manufacturers [43]. Furthermore, the results of the recent studies reveal that the need for IS in QM is increasing rapidly.

3. RESEARCH HYPOTHESES

This study attempts to analyse the research model adapted from [5] as shown in Figure 1. Arumugam et al. [5] suggested the integration of EFQM excellence model with IS criterion. In this study the EFQM excellence model and IS criterion of MBNQA model is structured by ten (10) criteria: leadership (LD); policy and strategy (PS); people (PPL); partnership and resources (PR); information systems (IS); processes (PRC); people results (PPLR); student results (SR); society results (SOR) and key performance results (KPR). The hypotheses of the study are as follows:

H1: Leadership is positively related to Policy and Strategy.
H2: Leadership is positively related to People.
H3: Leadership is positively related to Partnership and Resources.
H4: Leadership is positively related to Information Systems.
H5: Policy and Strategy are positively related to People.
H6: Policy and Strategy are positively related to Partnership and Resources.
H7: Policy and Strategy are positively related to Processes.
H8: People are positively related to Processes.
H9: Partnership and Resources are positively related to Processes.
H10: Information Systems are positively related to Policy and Strategy.
H11: Information Systems are positively related to People.
H12: Information Systems are positively related to Partnership and Resources.
H13: Information Systems are positively related to Processes.
H14: Processes are positively related to People results.
H15: Processes are positively related to Customer results.
H16: Processes are positively related to Society results.
H17: People are positively related to Customer results.
H18: People results are positively related to Key performance results.
H19: Customer results are positively related to Key performance results.
H20: Society results are positively related to Key performance results

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

.

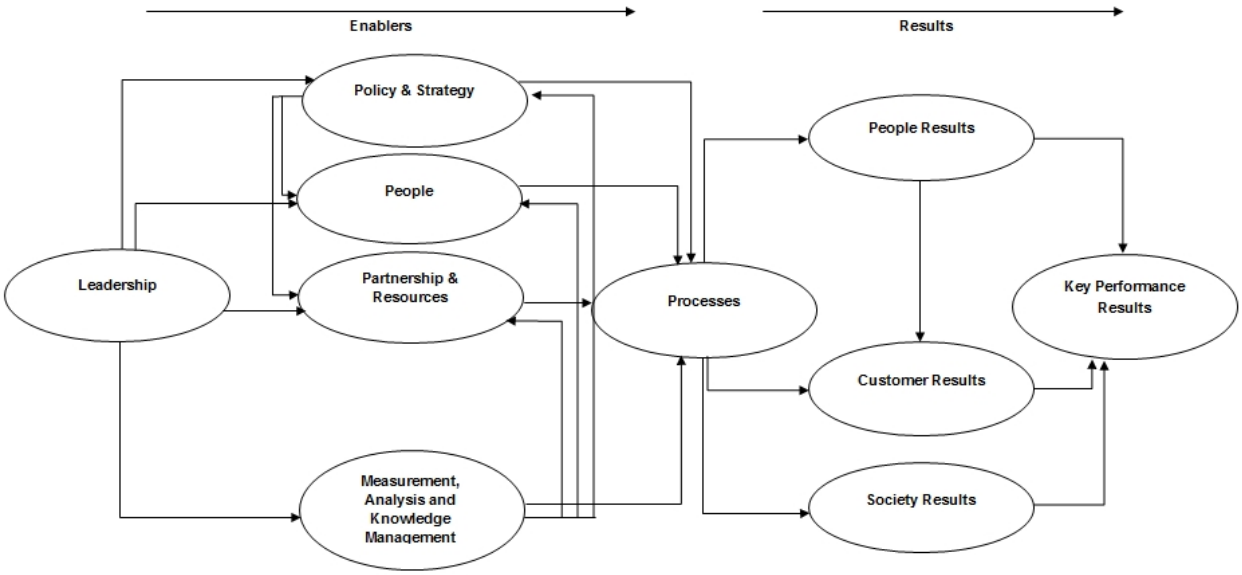

Figure 1: Research model(adapted from [5]*)*

4. RESEARCH METHODOLOGY

The questionnaire comprised of 70 items that were used to determine nine (9) EFQM excellence model criteria adapted from Calvo-mora et al. [34]. In addition, 12 items were also included in the questionnaire to measure the information systems criterion. These 12 items had been identified from the Badri et al. [31] and He et al. [44]. The authors chose these items because it reflect to the EFQM excellence model and can be applied to HEI which was the focus of this study. The degree of each item is determined using a five-point Likert scale ranging from 1=strongly disagree to 5=strongly agree.

The sample of HEIs was chosen from the Ministry of Higher Education's directory. The final population contained the 230 HEIs that registered all of the information needed in this study (email, phone number, etc.). The questionnaire was emailed to the vice chancellor/director of the HEIs and requested that the questionnaire be passed to the person in charge of quality management that are familiar with the practice of quality management at their HEI. The accumulation of data took approximately three months starting from 15 January 2015 to 15 April 2015.

We obtained 126 returned questionnaires, only 118 sets used for the analysis due to the incompleteness of 8 sets of questionnaires, giving a response rate of 51%. From 118 HEIs, 14 of respondents were from public institutions while 104 from private institutions. Most of the institutions were college (48.3%) and university (40.68%). The remaining was university college (8.47%) and branch campus university (2.5%).

5. RESULTS AND DISCUSSIONS

5.1 Normality

Hair et al. [45] and Pallant [46] elaborated that normality could be assessed by calculating the absolute values of skewness (<3) and kurtosis (<8). It is clearly seen that the skewness and kurtosis values for all 82 items are less than the related threshold values and thus, it can be concluded that there is no variation from normality for all 10 dimensions in the study.

5.2 Multicollinearity

If the correlation between the two items is 0.9 or higher, it shows the existence of multicollinearity problem [47]. The correlation matrix obtained from AMOS software showed there is no multicollinearity problem.

5.3 Reliability of the Instrument

A Cronbach's alpha between 0 and 0.6 is poor, between 0.6 and 0.8 is mediocre, and

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

between 0.8 and 1 is good [48]. The overall reliability of the instrument is 0.986, which is more than 0.8 and it indicates that the reliability of the questionnaire used in this study is good.

5.4 Construct Validity

Two types of validity known as convergent validity and discriminant validity are used. According to Hair et al. [45], convergent validity evaluates the level of correlation between two measures of a single concept while discriminant validity is the extent of distinction between two concepts which are conceptually similar.

5.4.1 Convergent Validity

High loading on a factor shows that they converge on some common points. The rule of thumb here is that all standardized loading estimates should be 0.5 or higher [45]. In this study, loadings for all items are higher than 0.5

5.4.2 Discriminant Validity

This method compares the variance-extracted percentages for any two constructs with the square of the correlation estimate between the two constructs. The guideline is that the variance-extracted must have values higher than those of the squared correlation. The comparison of Tables 1 and 2 evidenced the discriminant validity of the variables.

Table 1: Variance Extracted (VE) values for the research variables

LD	SP	PPL	PR	IS	PRC	PPLR	SR	SOR	KPR
0.767	0.762	0.769	0.735	0.709	0.740	0.669	0.662	0.665	0.630

Table 2: Square of correlation values of the research variables

	SOR	LD	PS	PPL	PR	IS	PRC	PPLR	SR	KPR
SOR	0.816									
LD	0.529	0.876								
PS	0.650	0.784	0.873							
PPL	0.578	0.728	0.701	0.877						
PR	0.588	0.397	0.570	0.560	0.857					
IS	0.622	0.659	0.776	0.709	0.564	0.842				
PRC	0.755	0.477	0.712	0.659	0.696	0.692	0.860			
PPLR	0.654	0.464	0.524	0.610	0.536	0.477	0.616	0.818		
SR	0.431	0.297	0.365	0.451	0.215	0.349	0.529	0.398	0.814	
KPR	0.570	0.355	0.463	0.440	0.480	0.473	0.628	0.389	0.475	0.794

5.5 Overall Fitness of Structure Model

We use Structural Equation Model (SEM) via the Analysis of Moment Structures (AMOS) software to evaluate the paths between the research model criteria and examine the hypotheses. SEM is use to evaluate the paths of the ten (10) criteria of the research model and estimated the model parameters.

According to Hair et al. [45] applying three to four fit indices adequately evidences the fitness of the model. Researcher should report at least one absolute index and one incremental index, in addition to the *x2* value and the associated degrees of freedom. Hair et al. [45] also stated that Comparative fit index (CFI), Tucker Lewis index (TLI) and Root mean square error of approximation (RMSEA) are the most common indices in assessing the fitness of a model.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 3. Overall model fit statistics

Overall model fit	Statistic value
p (x^2=805.292; df = 296)	0
CMIN/DF (Minimum chi square/degree of freedom)	2.721
CFI (Comparative fit index)	0.928
TLI (Tucker Lewis index)	0.914
IFI (Incremental fit index)	0.928
RMSEA (Root mean square error of approximation)	0.068

The results for the assessment of the overall fitness of the model indicate that the majority of fitness indices have acceptable values as shown in Table 3. In more specific, the results show that CMIN/DF equals to 2.721 (less than 3), CFI equals to 0.928 (more than 0.9), TLI equals to 0.914 (more than 0.9), IFI equals to 0.928 (more than 0.9), and RMSEA equals to 0.068 (less than 0.9) which reveal appropriate fitness for the SEM analysis [31], [49], [50]. Thus, the research model in this study is acceptable [45].

Table 4: Results of hypotheses

Hypothesis	Path	Estimate	SE	CR	Hypothesis supported
H1	Leadership → Policy and Strategy	.536	.086	6.229	**
H2	Leadership → People	.520	.095	5.479	**
H3	Leadership → Partnership and resources	.328	.119	2.749	**
H4	Leadership → Information Systems	.829	.093	8.943	**
H5	Policy and Strategy → People	.354	.079	4.500	**
H6	Policy and Strategy → Partnership and resources	.469	.105	4.481	**
H7	Policy and Strategy → Processes	.139	.079	1.759	ns
H8	People → Processes	.315	.084	3.773	*
H9	Partnership and resources → Processes	.603	.049	12.222	**
H10	Information Systems → Policy and Strategy	.400	.060	6.694	**
H11	Information Systems → People	.110	.063	1.743	ns
H12	Information Systems → Partnership and resources	.218	.085	2.555	**
H13	Information Systems → Processes	-.076	.056	-1.354	ns
H14	Processes → People results	.991	.071	14.054	**
H15	Processes → Student results	.678	.138	4.897	**
H16	Processes → Society results	.996	.073	13.733	**
H17	People results → Student results	.020	.103	.194	ns
H18	People results → Key performance	.142	.056	2.535	*

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

	results				
H19	Student results → Key performance results	.235	.042	5.596	**
H20	Society results → Key performance results	.236	.058	4.060	**

This study attempted to evaluate the interrelationships between the EFQM excellence model and information systems criterion of MBNQA model in the HEIs. Apparently, only four (4) out of the 20 hypotheses postulated are not supported by the actual data while 16 others are strongly supported. The results are shown in Table 4.

Firstly, the results show that leadership is positively related to policy and strategy (H1), people (H2), partnership and resources (H3), and information systems (H4). These results are confirmed to the previous studies such as in [10], [29], [31], [34].

Secondly, policy and strategy are positively related to people (H5) and partnership and resources (H6), however it is not positively related to processes (H7). The existing studies [10], [29], [31], [34] also confirmed that policy and strategy are positively related to people, partnership and resources.

Thirdly, people (H8) and partnership and resources (H9) are positively related to processes, and these results are confirmed to the previous studies such as in [9], [10], [34], [51].

Fourthly, information systems are positively related to policy and strategy (H10) and partnership and resources (H12), but do not positively related to people (H11) and processes (H13). The positively related results are in line with the findings in the studies such as [31], [39].

Fifthly, processes are positively related to people results (H14), student results (H15) and society results (H16). These results are in line with the existing findings in [9], [33], [34].

Finally, the study also confirms the existence of internal effect between the results of the model such as in [33], [34]. People results (H18), student results (H19) and society results (H20) are positively related to key performance results. However, people results are not positively related to student results (H17).

6. CONCLUSION AND FURTHER RESEARCH

The current study successfully extended the EFQM excellence model by integrating the EFQM excellence model with information systems criterion of MBNQA model. The findings derived from the SEM model proved the fitness of the causal model and revealed some causal relationships among the dimensions of the research model.

The outcomes of the statistical analysis conducted also revealed that the supportive effects of information systems dimension in the extended EFQM excellence model in Malaysian HEIs are according to the idea proposed by the IS-QM theory and TQM theory. Therefore, it can be concluded that the data have supported the assumptions of IS-QM theory which indicate that information systems can be integrated with EFQM model and support its dimensions.

Some limitations must be considered when it comes to interpreting the results and conclusions. The first limitation was that the results of this study were specific to Malaysian HEIs. As a result, more research is needed to study the effects of information systems criterion on the EFQM excellence model in other sectors, such as servicing, manufacturing, and health care sectors. Secondly, this study integrates information systems criterion of MBNQA model with the EFQM excellence model. Hence, other management frameworks, such as the Balanced Scorecard and Deming model can be integrated with information systems of MBNQA model.

REFERENCES:

[1] S. Reichert, *The rise of knowledge regions: emerging opportunities and challenges for universities*, vol. 1. 2006.

[2] N. Azman, M. Sirat, and M. A. Karim, "Building future scenarios for Malaysian universities," *J. Asian Public Policy*, vol. 3, no. 1, pp. 86–99, 2010.

[3] M. of H. E. Malaysia, "The National

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Higher Education Strategic Plan Beyond 2020," Malaysian Government Press, Putrajaya, 2007.

[4] J. Johnes, "Efficiency and productivity change in the english higher education sector from 1996/97 to 2004/5," *Manchester Sch.*, vol. 76, no. 6, pp. 653–674, 2008.

[5] V. Arumugam, E. Sadeh, and C. Malarvizhi, "Review on the Supportive Effects of Information Criterion on Components of EFQM Excellence Model.," *J. Appl. Sci. Res.*, vol. 5, no. 7, pp. 911–914, 2011.

[6] V. Mavroidis, S. Toliopoulou, and C. Agoritsas, "A comparative analysis and review of national quality awards in Europe: Development of critical success factors," *TQM Mag.*, vol. 19, no. 5, pp. 454–467, 2007.

[7] L. O. Oyewobi, A. O. Windapo, and J. O. B. Rotimi, "Measuring strategic performance in construction companies: a proposed integrated model," *J. Facil. Manag.*, vol. 13, no. 2, p. 109, 2015.

[8] C.-T. Su, S.-C. Li, and C.-H. Su, "An empirical study of the Taiwan National Quality Award causal model," *Total Qual. Manag. Bus. Excell.*, vol. 14, no. 8, pp. 875–893, Oct. 2003.

[9] B. B. Flynn and B. Saladin, "Further evidence on the validity of the theoretical models underlying the Baldrige criteria," *J. Oper. Manag.*, vol. 19, no. 6, pp. 617–652, Nov. 2001.

[10] D. D. Wilson and D. a. Collier, "An Empirical Investigation of the Malcolm Baldrige National Quality Award Causal Model," *Decis. Sci.*, vol. 31, no. 2, pp. 361–383, Jun. 2000.

[11] S. Dror, "The Balanced Scorecard versus quality award models as strategic frameworks," *Total Qual. Manag. Bus. Excell.*, vol. 19, no. 6, pp. 583–593, Jun. 2008.

[12] D. H. Lee and D. H. Lee, "A comparative study of quality awards: Evolving criteria and research," *Serv. Bus.*, vol. 7, no. 3, pp. 347–362, 2013.

[13] R. D. Gulbro, L. Shonesy, and P. Dreyfus, "Are small manufacturers failing the quality test?," *Ind. Manag. Data Syst.*, vol. 100, no. 2, pp. 76–80, 2000.

[14] F. Dewhurst, A. R. Martínez-Lorente, and B. G. Dale, "TQM in public organisations: an examination of the issues," *Manag. Serv. Qual.*, vol. 9, no. 4, pp. 265–274, 1999.

[15] J. K. Eskildsen, K. Kristensen, and H. J. Juhl, "Private versus public sector excellence," *TQM Mag.*, vol. 16, no. 1, pp. 50–56, 2004.

[16] S. A. Black and L. J. Porter, "Identification of the Critical Factors of TQM," *Decis. Sci.*, vol. 27, no. 1, pp. 1–21, Mar. 1996.

[17] A. H. Westlund, "Measuring environmental impact on society in the EFQM system," *Total Qual. Manag.*, vol. 12, no. 1, pp. 125–135, Jan. 2001.

[18] R. A. Davis and G. L. Stading, "Linking firm performance to the Malcolm Baldrige National Quality Award implementation effort using multiattribute utility theory," *Manag. Financ.*, vol. 31, no. 3, pp. 19–34, Mar. 2005.

[19] Baldrige National Quality Program, "2011-2012 Baldrige National Quality Program: Education Criteria for Performance Excellence," Gaithersburg, MD: National Institute of Standards and Technology, 2012.

[20] P. B. Cragg, "The information systems content of the Baldrige and EFQM Models," *Total Qual. Manag. Bus. Excell.*, vol. 16, no. March 2015, pp. 1001–1008, 2005.

[21] M. Arif, "Baldrige theory into practice: a generic model," *Int. J. Educ. Manag.*, vol. 21, no. 2, pp. 114–125, 2007.

[22] J. R. Jack, Eric P. Stephens, Paul R. Evans, "An Integrative Summary of Doctoral Dissertation Research in Quality Management," *Prod. Oper. Manag.*, vol. 10, no. 4, pp. 363–382, Jan. 2001.

[23] M. Hides, J. Davies, and S. Jackson, "Implementation of EFQM excellence model self-assessment in the UK higher education sector - lessons learned from other sectors," 2004.

[24] EFQM, *EFQM excellence model 2013*. Bruxelles: EFQM, 2012.

[25] P. A. C. Miguel, "Comparing the Brazilian national quality award with some of the major prizes," *TQM Mag.*, vol. 13, no. 4, pp. 260–272, 2001.

[26] M. Saunders, R. Mann, and N. Grigg,

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

"Review processes for improving business excellence frameworks," *International Journal of Quality & Reliability Management*, vol. 25, no. 9. pp. 928–942, 2008.

[27] M. Sharma and R. Kodali, "TQM implementation elements for manufacturing excellence," *TQM J.*, vol. 20, no. 6, pp. 599–621, 2008.

[28] J. C. Bou-Llusar, A. B. Escrig-Tena, V. Roca-Puig, and I. Beltrán-Martín, "An empirical assessment of the EFQM Excellence Model: Evaluation as a TQM framework relative to the MBNQA Model," *J. Oper. Manag.*, vol. 27, no. 1, pp. 1–22, Jan. 2009.

[29] B. A. Winn and K. S. Cameron, "Organizational quality : An Examination of the Malcolm Baldrige National Quality Framework," *Res. High. Educ.*, vol. 39, no. 5, pp. 491–512, 1998.

[30] G. P. Pannirselvam and L. A. Ferguson, "A study of the relationships between the Baldrige categories," *Int. J. Qual. Reliab. Manag.*, vol. 18, no. 1, pp. 14–37, 2001.

[31] M. A. Badri, H. Selim, K. Alshare, E. E. Grandon, H. Younis, and M. Abdulla, "The Baldrige Education Criteria for Performance Excellence Framework: Empirical test and validation," *Int. J. Qual. Reliab. Manag.*, vol. 23, no. 9, pp. 1118–1157, 2006.

[32] Conti and T. A., "A history and review of the European Quality Award Model," *TQM Mag.*, vol. 19, no. 2, pp. 112–128, 2007.

[33] E. Sadeh, V. C. Arumugam, and C. a. Malarvizhi, "Integration of EFQM framework and quality information systems," *Total Qual. Manag. Bus. Excell.*, vol. 24, no. 1–2, pp. 188–209, Feb. 2013.

[34] A. Calvo-mora, A. Leal, and J. L. Roldán, "Relationships between the EFQM model criteria: a study in Spanish universities," *Total Qual. Manag. Bus. Excell.*, vol. 16, no. 6, pp. 741–770, Aug. 2005.

[35] C. Forza, "Quality information systems and quality management," *Ind. Manag. Data Syst.*, vol. 95, no. 2, pp. 6–14, Mar. 1995.

[36] X. Tang, G. Duan, and K. S. Chin, "Development and implementation of an integrated quality information system-a China experience," *Int. J. Adv. Manuf. Technol.*, vol. 32, no. 5–6, pp. 608–616, 2007.

[37] F. Dewhurst, A. R. M. Lorente, and B. G. Dale, "Total quality management and information technologies: an exploration of the issues," *Int. J. Qual. Reliab. Manag.*, vol. 16, no. 4, pp. 392–406, 1999.

[38] F. W. Dewhurst, A. R. Martínez-Lorente, and C. Sánchez-Rodríguez, "An initial assessment of the influence of IT on TQM: a multiple case study," *Int. J. Oper. Prod. Manag.*, vol. 23, no. 4, pp. 348–374, 2003.

[39] D. Hemsworth, C. Sánchez-Rodríguez, and B. Bidgood, "A structural model of the impact of Quality Management Practices and purchasing-related Information Systems on purchasing performance: A TQM perspective," *Total Qual. Manag. Bus. Excell.*, vol. 19, no. 1–2, pp. 151–164, 2008.

[40] A. R. Martínez-Lorente, C. Sánchez-Rodríguez, and F. W. Dewhurst, "The effect of information technologies on TQM: An initial analysis," *Int. J. Prod. Econ.*, vol. 89, no. 1, pp. 77–93, 2004.

[41] C. Sánchez-Rodríguez, F. W. Dewhurst, and A. R. Martínez-Lorente, "IT use in supporting TQM initiatives: an empirical investigation," *Int. J. Oper. Prod. Manag.*, vol. 26, no. 5, pp. 486–504, 2006.

[42] R. Ismail, M. A. A. Murad, M. A. Jabar, and R. N. H. Nor, "The Effect of Information Systems Criterion on the EFQM Model in Institutions of Higher Education," *Am. J. Appl. Sci.*, vol. 12, no. 12, pp. 993–999, Dec. 2015.

[43] X. Tang, "Integrated quality information system and China experience," *IFIP Int. Fed. Inf. Process.*, vol. 207, pp. 54–61, 2006.

[44] Z. He, J. Hill, P. Wang, and G. Yue, "Validation of the theoretical model underlying the Baldrige criteria: Evidence from China," *Total Qual. Manag. Bus. Excell.*, vol. 22, no. 2, pp. 243–263, Feb. 2011.

[45] R. E. Hair, J.F., Black, W.C., Babin, B.J., & Anderson, *Multivariate data analysis (7th ed.)*. New York: NY: Pearson Education International., 2010.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[46] J. Pallant, *SPSS survival manual; A step by step guide to data analysis using SPSS for windows (3rd ed.)*. Sydney: Open University Press, 2007.

[47] B. G. Tabachnick and L. S. Fidell, *Using Multivariate Statistics*. Boston: Pearson Education, 2007.

[48] U. Sekaran, *Research methodology for business*. New York: John Wiley and Sons, Inc, 2003.

[49] M. W. Browne and R. Cudeck, "Alternative Ways of Assessing Model Fit," *Sociol. Methods Res.*, vol. 21, no. 2, pp. 230–258, Nov. 1992.

[50] G. Browne, M. and Mels, *RAMONA User's Guide*. Columbus, OH: Department of Psychology, The Ohio State University, 1994.

[51] J. J. Tarí and S. De Juana-Espinosa, "EFQM model self-assessment using a questionnaire approach in university administrative services," *TQM Mag.*, vol. 19, no. 6, pp. 604–616, 2007.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

APPENDIX: *Questionnaire*

Leadership

LD1 Leader develop the organization's mission, vision and values
LD2 Leader communicate the mission, vision and values to all levels of the organization
LD3 Leader improve their actions, making them fit in with the organization's present and future needs
LD4 Leader design an university structure suitable for the university's policies and strategies
LD5 Leader implement a system of key processes or activities supporting the university's policy and strategy, and its goals
LD6 Leader keep in touch with the different stakeholders in order to know their expectations and opinions
LD7 Leader encourage student's and staff's involvement in the improvement actions
LD8 Leader publicly acknowledge the successes of people and groups in quality improvement actions

Policy and Strategy

PS1 The organization's policies and strategies are in line with its mission, vision and values
PS2 The organization's policies and strategies are clearly formulated in writing
PS3 All the areas in the University are involved in the process of formulating and communicating the policies and strategies
PS4 There is a formal process of reviewing and updating policies and strategies
PS5 The organization's policies and strategies are structured in a Strategic Plan
PS6 The organization's goals are set out in writing and in a clear and quantifiable manner
PS7 The goals are communicated at all levels of the organization
PS8 The principles of quality are incorporated into all of the University's policies, strategies and goals
PS9 There is a procedure allowing for the deployment of the policies and strategies and for their being turned into short term plans
PS10 The formulation and revision of policies and strategies include the needs and expectations of the stakeholders

People

PPL1 Identifying the staff's present and future needs regarding knowledge, competencies and skills
PPL2 Developing training plans for the improvement of the staff's knowledge, competencies and skills
PPL3 Promoting actions which support the staff's commitment and involvement in the improvement actions
PPL4 Encouraging the staff's assumption of responsibilities and empowerment to carry out improvement actions
PPL5 Developing suitable channels for sharing and communicating 'better practices', knowledge and experiences
PPL6 Recognizing quality improvement related efforts, either at a personal or group level
PPL7 Establishing social benefits and improvement of the staff's services and facilities
PPL8 Encouraging the staff's involvement in topics related to health and safety, the environment, and social and ethic responsibility

Partnerships and Resources

PR1 Establishing of partnership to generate value and mutual benefits
PR2 Development of agreements guaranteeing the exchange of knowledge and experiences with partners
PR3 Making appropriate investments for the development of the organization's policy, strategy and continuous improvement
PR4 Identification and evaluation of the impact of new technologies on the University
PR5 Implementation of mechanisms for the collection and use of data supporting the organization's policy and strategy
PR6 Implementation of mechanisms for the identification of the information needs of the stakeholders
PR7 Use of information for the continuous improvement of the management system and the services

Information Systems

IS1 Our institution systematically collects data and information, in order to trace, review and improve organisational performance.
IS2 Our institution communicates with partners frequently regarding design changes and key factors affecting product/service quality.
IS3 Our institution does well in integrating performance information with innovation.
IS4 Senior executives in our institution analyze data by themselves for strategic planning and decision making.
IS5 Our institution provides the results of performance data analysis to business units or departments.
IS6 Employees in our institution can easily acquire and use corporate information and data.
IS7 Our suppliers, partners and customers can share our institution's data and information.
IS8 Our institution asks suppliers to participate in our quality improvement projects.
IS9 Our institution acquires data and information from employees, customers, suppliers and partners, and shares the data and information inside our company.
IS10 We often ask suppliers for suggestions regarding product/service designs.
IS11 Our institution's data and information are complete, consistent, and accurate.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

IS12 Employees can use quality management tools to analyze data and information, and look for quality improvement opportunities.

Processes

PRC1 The teaching activity envisages the students' needs and expectations
PRC2 The teaching activity envisages the companies' needs and expectations
PRC3 The teaching activity envisages the needs and expectations of the community or the society in general
PRC4 The research activity envisages the students' needs and expectations
PRC5 The research activity envisages the companies' needs and expectations
PRC6 The research activity envisages the needs and expectations of the community or the society as a whole
PRC7 The organization makes efforts addressed to identifying and analysing key processes and actions
PRC8 There is documentary support for processes (field of action, the actions they are made of, validity, etc.)
PRC9 Data are collected about claims and suggestions of the stakeholders, then used to improve the processes
PRC10 Procedures are developed aimed at guaranteeing the adequate provision of services to the stakeholders

People results

PPLR1 Number of complaints by the staff
PPLR2 Average time needed to solve staff complaints
PPLR3 Absenteeism and off-work rates
PPLR4 Staff satisfaction
PPLR5 Staff Involvement in improvement actions and suggestions made
PPLR6 Staff Involvement in actions regarding training and retraining skills and knowledge
PPLR7 Degree of achievement of training plans, and promotion and development plans

Student results

SR1 Average time needed to respond or solve a complaints
SR2 Number of complaints submitted by students
SR3 Number of student failed
SR4 Number of student dropout
SR5 Student satisfaction
SR6 Graduation rate in the theoretical time

Society results

SOR1 Organization image in the community or society
SOR2 Support of cultural or sport activities
SOR3 The satisfaction of the surrounding community or society
SOR4 The tendency and evolution of the surrounding community or society with regards to the organization
SOR5 Risk prevention
SOR6 Environment protection and preservation by reducing waste and pollutant emissions
SOR7 Promote recycle (paper, cartons, toner, etc.)

Key Performance Results

KPR1 Improvement on the times needed for service provision and process performance (registration, issuing of certificates, internal mail, library, economic management of payment orders, etc.)
KPR2 Employment rate for graduate students from the organization
KPR3 Number of postgraduate (Doctorate) theses
KPR4 Number of research projects obtained from public institutions
KPR5 Number of registered patents and utility models
KPR6 Degree of performance of the costs and revenues budge
KPR7 Ratio of own/third-party resources