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# The Effect of Information Systems Criterion on the EFQM Model in Institutions of Higher Education

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**Abstract:** The purpose of this paper is to empirically test the effect of information systems criterion on the European Foundation for Quality Management (EFQM) excellence model in Higher Education Institutions (HEIs). The paper identifies five (5) causal hypotheses from literatures that are related to the information systems criterion. The data were collected from 118 Malaysian higher education institutions through the questionnaire survey. The empirical data were analysed using Structural Equation Model (SEM) via the AMOS version 21 software. The respondents are limited only to the quality managers in Malaysian higher education institutions. The results indicate that there are three (3) significant relations and two (2) insignificant relations within the model. Leadership has positive effects on information systems and information systems have positive effects on policy and strategy; and partnership and resources.However, information systems do not have positive effect on people and processes. By using information systems in EFQM excellence model is necessary for the improvement of quality in the field of higher education institutions.

**Keywords:** Information Systems, EFQM, MBNQA, Higher Education Institutions

## Introduction

Recently, many authors supported the significance of information systems in supporting organizational quality. Information system is a critical criterion in an effective management of the organizations and in identifying areas of improvement. The Total Quality Management (TQM) literature also emphasizes on decision making based on facts that involves analysis of information about customers' needs, problems in term of processes and activities and the success or failures of corrective attempts (Samson and Terziovski, 1999). Clearly, the information systems criterion is one of the TQM core concepts, but information systems is not exist in EFQM excellence model as a single criterion (Arumugam *et al*., 2011). In the other hand, information systems is considered in the MBNQA model and some other national excellence award frameworks, such as Australian Business Excellence model, Singapore Quality Award model and Malaysian Quality Management Excellence Award to support the remaining criteria which fall under customer and market focused strategy and action plans (Bou-Llusar *et al*., 2009; Sharma and Kodali, 2008). According to Tannock *et al*. (2002), without sufficient information and data, the organization cannot identify the weaknesses in their policy and strategy, people management and processes. As a result, improvement areas are not distinguished and corrective actions are not performed. Thus in this study the researchers empirically test the effect of measurement, analysis and knowledge management criterion on leadership; policy and strategy; people; partnership and resources; and processes, the criteria in EFQM excellence model as a single model to weave the information systems function into an organizational context.

### *The EFQM Excellence Model*

The EFQM excellence model was introduced at the beginning of 1992 as the framework for assessing organisations for the European Quality Award. It is now the most widely used framework in Europe (Eskildsen and Dahlgaard, 2000) and has become the basis for the majority of national and regional Quality Awards. The EFQM excellence model is a non-prescriptive framework based on nine (9) criteria. Five of these are 'Enablers' (leadership, people, policy strategy, partnership and resources and

processes) and four are 'Results' (people results, customer results, society results and business results).

### *The MBNQA Model*

MBNQA was created in 1987 by the National Institute of Standard and Technology (NIST), an agency under the US Department of Commerce (NIST, 2012). The MBNQA criteria represent a comprehensive framework of seven categories that are used to evaluate an organization's performance. The categories cover: (1) leadership, (2) strategic planning, (3) student, stakeholder and market focus, (4) measurement, analysis and knowledge management, (5) workforce focus, (6) process management and (7) results.

### *Comparison of the Excellence Awards*

According to Sharma and Kodali (2008), the excellence award models are applied as the model of the TQM theory to link the concepts and to assist in translating the theory into practice through a number of systematic means. They discussed among 19 identified excellence awards around the world and indicated three best-known and original excellence awards, including MBNQA, EFQM and Deming Prize. Other excellence awards are derived from the three main awards with slight modifications such as addition of some new elements due to the changes in the business environment. The researchers justified two excellence award models which comprehensively represent the TQM theory, namely, the MBNQA model and EFQM excellence model and further compared them as the models of the core TQM elements. The comparison between the core TQM elements, as represented by the MBNQA and EFQM models, is shown in Table 1.

This is also supported by Bou-Llusar *et al*. (2009) who have indicated the correspondence between the criteria of the two excellence award models (EFQM and MBNQA) representing the core concepts of TQM. The correspondence between the excellences criteria are presented in Table 2.

Clearly, the information systems criterion is one of the TQM core concepts, but it is not considered in the EFQM excellence model (Bou-Llusar *et al*., 2009; Sharma and Kodali, 2008).

### *The Role of Information Systems in Quality Management Model*

Quality management had been widely studied up to the 1990s, however very little attention had been paid to the contribution of information systems to quality management practices (Sadeh *et al*., 2013).

Table 1. A comparison between the core TQM elements represented by the MBNQA and EFQM (Sharma and Kodali, 2008)

| TQM core concepts | EFQM model | MBNQA model |
|---|---|---|
| Leadership | Leadership | Leadership |
| Strategy, policy, planning | Policy and strategy | Strategic planning |
| Customer focus/satisfaction | | Customer and market focus |
| Market focus | | Customer and market focus |
| People management | People | Workforce focus |
| Resources Information management and analysis | Partnership and resources | Measurement, analysis and knowledge management |
| Process management/processes | Processes | Process management |
| | Customer results | |
| Employee satisfaction | People results | |
| Impact on society/responsibility | Society results | |
| Business results | Key performance results | Organizational performance results |

Table 2. The correspondence between the criteria of the MBNQA and EFQM (Bou-Llusar *et al*., 2009)

| TQM model based on quality award models | |
|---|---|
| EFQM Criteria (2012) | MBNQA Criteria (2012) |
| Leadership | Leadership |
| Policy and strategy | Strategic planning |
| People | Workforce focus |
| Partnership and resources | |
| | Customer, stakeholder and market focus |
| | Measurement, analysis and knowledge management |
| Processes | Process management |
| Customer results | |
| People results | |
| Society results | |
| Key performance results | Organizational performance results |

According to NIST (2012) information and analysis is a core fundamental concept which retains effect upon other categories in TQM model. Meanwhile, information systems helps organisations to share information with partners and enhances the trust between partners (Hems Worth *et al*., 2008).

Some researchers studied the roles of information systems criterion on quality model, Sadeh *et al*. (2013) improved the EFQM excellence model through integrating the model and quality information systems. This research studies the relationships between the dimensions of information systems and the criteria of the EFQM excellence model. Results indicate that leadership had positive impacts on information systems; information system had positive impacts on policy and strategy, partnership and resources, people and processes.

Xiang *et al*. (2010) investigated the relationships between the categories of China Quality Award model based on the criteria of MBNQA model. They found that information and analysis dimension had positive impacts on policy and strategy, customer, stakeholder and market focus, people and processes.

Sohn *et al*. (2007) suggested an SEM model formed by the MBNQA criteria, for the assessment of national funding on the Rand D programme of SMEs in Korea. In their study, the results indicated that information systems criterion had positive effects on policy and strategy, people and processes.

Badri *et al*. (2006) tested the causal relationships of excellence criteria using the dimensions of MBNQA model in United Arab Emirates (UAE) higher education institutions. They found that, information systems criterion has a positive influence on strategy and policy, people and processes. In addition, they also found that, leadership had a positive influence on information systems criterion.

Flynn and Saladin (2001) studied the causal relationships of MBNQA model of the manufacturing sector in US. The results shown that information systems criterion was directly affected by leadership. In addition, information systems criterion was also found to have significant influence on policy and strategy, people and processes.

Meyer and Collier (2001) analysed the causal relationships among MBNQA model criteria in American hospitals. They found that, information systems criterion has positive effects on strategy, people and processes. In addition, it was revealed that leadership has positive influence on information systems criterion.

Wilson and Collier (2000) examined the assumptions of the theory and the relationship among the MBNQA model categories. The results shown that information systems criterion had positive significant effects on the strategy, people and processes.

Dewhurst *et al*. (1999) reviewed the relationships between Information Technology (IT) and the TQM enablers. They concluded that Information Technology (IT) is an effective enabler in the TQM implementation process as it can influence all the dimensions of TQM considered in their research.

### *Research Hypotheses*

This paper attempts to verify the causal relationships of measurement, analysis and knowledge management criterion on leadership; policy and strategy; people; partnership and resources; and processes, the criteria in EFQM excellence model as a single model as shown in Fig. 1.

Information and analysis is a core fundamental concept for quality performance to manage institutions effectively (Moon *et al*., 2011; Xiang *et al*., 2010).

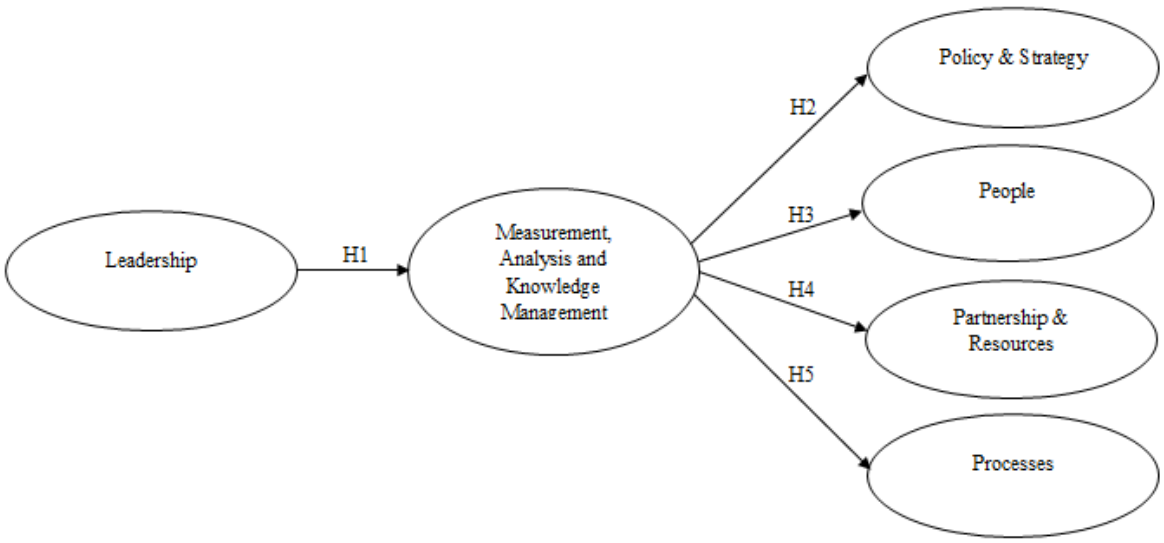


Fig. 1. Research model and hypotheses

Leadership has effect on information and analysis and information and analysis had effects on other categories of the quality model (Xiang *et al*., 2010). The proposed hypotheses as below:

H1: Leadership has causal positive effect on Measurement, Analysis and Knowledge Management.
H2: Measurement, Analysis and Knowledge Management have causal positive effect on Policy and Strategy.
H3: Measurement, Analysis and Knowledge Management have causal positive effect on People.
H4: Measurement, Analysis and Knowledge Management have causal positive effect on Partnership and Resources.
H5: Measurement, Analysis and Knowledge Management have causal positive effect on Processes.

## Materials and Methods

### *Sample and Instrument*

The questionnaire comprised of 43 items of the EFQM standard questionnaire which were used to determine five (5) criteria (leadership, policy and strategy, people, partnership and resources and processes) adapted from (Calvo-Mora *et al*., 2005). Also in this study, measurement, analysis and knowledge management criterion is evaluated using 5 items from Badri *et al*. (2006). Since the focus of our study is on the HEIs, the authors chose those items that are applicable and useful for them from previous studies. As in some previous studies, the degree of each indictor is determined using a five-point Likert scale.

The research sample consisted of 230 Malaysian higher education institutions. The list of respondents was obtained from the Ministry of Higher Education of Malaysia. They represented the various types of HEIs in Malaysia: Universities and colleges and public and private HEIs. For each HEI, the quality manager in charge of quality management in HEI was asked to complete the survey. These individuals typically have significant knowledge of the institutions' performance and quality management, thus providing some legitimacy and reliability to the responses. Sampling and data collection took about three months, which was conducted between 15 January 2015 and 15 April 2015. Finally, a total of 118 completed questionnaires (response rate 51%) were received from Malaysian HEIs.

## Results

### *Convergent Validity*

To verify feasibility of model, researchers used Confirmatory Factor Analysis (CFA) via the AMOS version 21 software. The convergent and discriminant validity is evaluated to validate the model. The questions should have at least 0.60 on their component and all loadings need to be significant ($p<0.05$, $t > 2.0$) (Hair *et al*., 2010).

For a construct to have good reliability, Composite Factor Reliability (CFR) should be at least 0.70 and the Average Variance Extracted (AVE) should be at least 0.50 (Hair *et al*., 2010). Thus, the questions which have multiple constructs or have low item loadings are deleted from the questionnaire. Finally, 9questions are deleted, 39questions remain in this questionnaire. The results are shown in Table 3.

### *Discriminant Validity*

The purpose of discriminant validity is to identify whether the correlation between constructs is not equal to 1.0 (Chin *et al*., 1997). The coefficient of the correlations should be less 0.9 (Hair *et al*., 2010). The Table 4 shows that all of the correlations among 6constructs are evidenced the discriminant validity of the variables.

Table 3. Fitness indices of measurement constructs

| Construct | Items | Cronbach's alpha | Final Items | CFI | NFI | TLI | IFI |
|---|---|---|---|---|---|---|---|
| Leadership | 1-8 (8) | 0.966 | 8 | 0.998 | 0.991 | 0.996 | 0.998 |
| Policy and strategy | 9-18 (10) | 0.966 | 8 | 0.997 | 0.991 | 0.992 | 0.997 |
| People | 19-26 (8) | 0.965 | 6 | 1.000 | 0.995 | 1.000 | 1.000 |
| Partnership and resources | 27-33 (7) | 0.953 | 6 | 0.997 | 0.993 | 0.990 | 0.997 |
| Measurement, analysis and knowledge management | 34-38 (5) | 0.923 | 5 | 1.000 | 1.000 | 1.000 | 1.000 |
| Processes | 39-48 (10) | 0.967 | 6 | 1.000 | 0.999 | 1.000 | 1.000 |
| Total | 1-48 | | 39 | | | | |

Notes: CFI, Comparative fit index; NFI, Normed fit index; TLI, Tucker Lewis index; IFI, Incremental fit index

Table 4. Square of correlation values between any pair of constructs

| | LD | PS | PPL | PR | MAKM | PRC |
|---|---|---|---|---|---|---|
| LD | 0.876 | | | | | |
| PS | 0.784 | 0.873 | | | | |
| PPL | 0.728 | 0.701 | 0.877 | | | |
| PR | 0.613 | 0.697 | 0.693 | 0.857 | | |
| MAKM | 0.659 | 0.776 | 0.709 | 0.564 | 0.842 | |
| PRC | 0.477 | 0.712 | 0.659 | 0.696 | 0.692 | 0.860 |

Notes: Leadership (LD); Policy and Strategy, (SP); People (PPL); Partnership and Resources (PR); Measurement, Analysis and Knowledge Management (MAKM); Processes (PRC)

Table 5. Overall model fit statistics

| Overall model fit statistic | Statistic value |
|---|---|
| p ($x^2$ = 1007.522; df = 373) | 0.000 |
| CMIN/DF | 2.701 |
| CFI | 0.921 |
| TLI | 0.907 |
| IFI | 0.921 |
| RMSEA | 0.068 |

Notes: Minimum Chi Square/Degree of Freedom (CMIN/DF); Comparative Fit Index (CFI); Normed Fit Index (NFI); Tucker Lewis Index (TLI); Incremental Fit Index (IFI); Root Mean Square Error of Approximation (RMSEA)

### *Structural Equation Model*

Researchers use Structural Equation Model (SEM) to examine the dependence relationships of the six (6) constructs. In this section, the model parameters are estimated and the hypotheses are tested. Researchers use SEM via the AMOS version 21 software to test the research hypotheses and examine the casual relationships between the constructs. Table 5 shows the fit statistics of the model. The fit statistics of the model indicate that the chi-square model was 1007.522 with degree of freedom (df) of 373. The minimum chi square/degree of freedom (CMIN/DF) is 2.701. The Comparative Fit Index (CFI) is 0.921, the Tucker Lewis Index (TLI) is 0.907 and Incremental Fit Index (IFI) is 0.921, these indicate a good fit to the data. The Root Mean Square Error of Approximation (RMSEA) is 0.068 this indicating a reasonable model fit (Badri *et al*., 2006; Browne and Cudeck, 1992; Browne and Mels, 1994). Thus, the structural model in this research is satisfactory and can be tested (Hair *et al*., 2010).

## Discussion

This study attempted to empirically test the relationships between the information systems criterion on the proposed model for higher education institutions. The results indicate that there are three (3) significant relations and two (2) insignificant relations within the model. The results are shown in Table 6.

First, the finding shows that leadership has a positive significant effect on measurement, analysis and knowledge management (H1). This result has been confirmed by other empirical studies such as those in (Badri *et al*., 2006; Flynn and Saladin, 2001; Wilson and Collier, 2000; Winn and Cameron, 1998; Su *et al*., 2003). In order to have competitive advantage to higher education institution, they must concentrate on using information systems effectively in order to respond to the needs quickly and rationally (Su *et al*., 2003).

Secondly, the finding shows that, measurement, analysis and knowledge management have a positive significant effect on policy and strategy (H2). This result is in line with the findings of other researchers such as in (Sohn *et al*., 2007; Badri *et al*., 2006; Flynn and Saladin, 2001; Wilson and Collier, 2000; Winn and Cameron, 1998), which indicate that the policy and strategy of organizations are strongly affected by feedback and information. Thus, institutions must establish appropriate policy and strategy and information system is crucial for such policy and strategy.

Thirdly, measurement, analysis and knowledge management do not have a positive significant effect on people (H3). However, in quality information systems theory support the causal relationships between the dimensions of information systems on others dimensions. Besides, there are empirical research's evidences such as in (Xiang *et al*., 2010; Sohn *et al*., 2007; Badri *et al*., 2006; Wilson and Collier, 2000; Meyer and Collier, 2001), indicating that the management of people is directly affected by information systems. Thus, higher education institutions should empower its people by consistently manages employee information with proper communication channel.

Fourthly, measurement, analysis and knowledge management have a positive significant effect on partnership and resources (H4). This result is also confirmed by empirical research's findings, such as in (Sohn *et al*., 2007; Badri *et al*., 2006; Wilson and Collier, 2000; Xiang *et al*., 2010; Sadeh *et al*., 2013), which indicate that the information and feedback received from customers can assist institutions to fulfil their customers' expectations, helps institutions to manage their resources and assist them to improve their relations with their external partners and suppliers. Hence, information systems should be employed to support quality management system.

Lastly, measurement, analysis and knowledge management do not have a positive significant effect on processes (H5). In this respect, the research does not coincide when verifying this hypothesis. However, according to quality information systems theory support the causal relationships between the dimensions of information systems and other dimensions. Besides, there are empirical research's evidences such as in (Xiang *et al*., 2010; Sohn *et al*., 2007; Badri *et al*., 2006; Flynn and Saladin, 2001; Meyer and Collier, 2001; Wilson and Collier, 2000) indicating that processes could be planned and managed effectively through appropriate management of information systems. In fact, information systems can be applied to contribute to the components of quality management system such as processes.

Table 6. Results of hypotheses testing extracted from output of AMOS software

| Hypothesis | Path | Estimate | SE | CR | Hypothesis supported |
|---|---|---|---|---|---|
| H1 | Leadership → Measurement, analysis and knowledge management | 0.826 | 0.093 | 8.873 | ** |
| H2 | Measurement, analysis and knowledge management → Policy and strategy | 0.404 | 0.060 | 6.716 | ** |
| H3 | Measurement, analysis and knowledge management → People | 0.117 | 0.064 | 1.830 | ns |
| H4 | Measurement, analysis and knowledge management → Partnership and resources | 0.229 | 0.086 | 2.656 | ** |
| H5 | Measurement, analysis and knowledge management → Processes | -0.109 | 0.056 | -1.940 | ns |

Notes: * $p<0.05$, ** $p<0.01$, ns, not significant

## Conclusion

The result shows that using information systems criterion in EFQM excellence model is necessary for the improvement of quality in the field of higher education institutions. The analysis of the structural model has allowed us to study the causal structure of the model in depth and knowledge of this structure may help higher education institutions to lead their management towards excellent results.

Based on the results, the following points are suggested to the higher education institutions. First, leadership of senior management of higher education institutions must support and facilitate the process of information systems through providing necessary devices and systems.

Subsequently, information systems must be put into practice through providing appropriate devices and systems to help senior management of higher education institutions to implement, improve and correct their planning based on accurate information.

This study has certain limitations that must be considered. A first limitation is this study was conducted in the higher education institutions; the results of this study merely specific to higher education institutions. As a result, more research are needed to study the contributions of proposed quality management model in other sectors, such as servicing companies, public organizations, manufacturing firms and health care organizations. Secondly, this study just focuses on information systems criterion in EFQM excellence model. Lastly, the current study was a cross-sectional research. Future longitudinal studies may be useful to obtain more appropriate results.

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## Author's Contributions

**Rosli Ismail:** Carried out the research, data collection, analysis and writing the paper.

**Masrah Azrifah Azmi Murad:** As the supervisor, she guided the research, gave a constructive comments and corrected the paper.

**Marzanah A. Jabar:** Contrubuted in validation and statistical tests.

**Rozi Nor Haizan Nor:** Contributed in conceptual model development and guided how to analyze the data.

## Ethics

The authors have read and approved the paper and no conflicts of interest in the publication of the paper.

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