

Investigation of the Effectiveness of ERP System on Management Decision-Making in Higher Educational Institutions

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Abstract

A survey of literature regarding ERP system supports for management decision-making in organizations revealed contrary views. According to some researchers, ERP systems only integrate business processes and functions and bring about efficiency in organizations. From various literature reviews, it is clear that there is an ambiguity in ERP systems effectiveness to support management decision-making. Research on ERP systems effectiveness impact on management decision-making in HEIs is rare. Therefore, this study seeks to investigate this phenomenon by adopting a framework of Peters and Aggrey to evaluate the influence of ERP systems effectiveness on management decision-making in HEIs. Using relevant theoretical foundations, a research model was developed to test five relevant hypotheses. Using quantitative research, data were collected from 150 administrators and managers of three case study universities in Ghana. Data was analyzed using PLS-SEM and the findings revealed that ERP systems effectiveness based on these perspectives (financial, learning and growth, customer/stakeholder and system quality) influence more significantly on management decision-making in HEIs unlike Internal business process perspective. The findings backed the idea that, ERP systems supports and improve management decision-making. The findings also support the research model proposed.

Keywords

ERP systems, ERP effectiveness, Balanced Scorecard, Management decision-making, HEIs

1. Introduction

Several researchers have studied ERP systems in higher education institutions in various situations and in different perspectives. Examples include Watson and Schneider (1999), Judith (2005), Kvavik et al., (2002), Beekhuyzen et al., (2002), Mehlinger (2006), Fisher (2006), Cornford and Pollock (2001), etc. Majority of these researchers focused their research on ERP systems implementation success and failure, critical success factors, impact of ERP systems on organization and business process performance. However, few or little of these researches have focused on framework, model or methodology development for evaluating ERP systems in higher education institutions. Common frameworks or models for evaluating ERP systems effectiveness or performance at post-implementation stage include Balanced Scorecard (BSC), Content Context Process (CCP), Stefanou's framework, ISO 25010 model, DeLone and McLean (D&M), technology acceptance model (TAM) and task-technology fit model (TTF). Each framework or model focuses on different aspects and has different perspectives on the evaluation of ERP systems.

However, none of these frameworks or models has been used singularly or has been combined to evaluate or determine the impact of ERP systems effectiveness on management decision-making in HEIs. This study adopt a framework of Peters and Aggrey (2019a), which integrate two well-known framework and a model (BSC framework and ISO 25010 model) to determine the influence of ERP systems effectiveness on management decision-making in HEIs. The proposed research model will help us to understand the relationship that exists between ERP systems effectiveness and management decision-making in higher education.

1.1 Research Objective

To investigate the ERP system effectiveness on management decision-making in HEIs using the adopted framework of Peters and Aggrey.

2. Literature Review

The literature review of this study is divided into two thematic sections: the theoretical background of the study and the research framework and hypotheses development.

2.1 Theoretical Background of the Study

The framework underpinning this study is an adopted framework of Peters and Aggrey (2019a), which integrates both BSC framework and ISO 25010 Model to evaluate the effectiveness of ERP systems in HEIs. In their framework, five perspectives or constructs (representing independent variables) and one construct (representing dependent variable) were used to evaluate the effectiveness of ERP systems in HEIs. Twenty-six (26) indicators were also proposed in their framework to measure these five perspectives or constructs. Figure 1 below shows their proposed analytic framework.

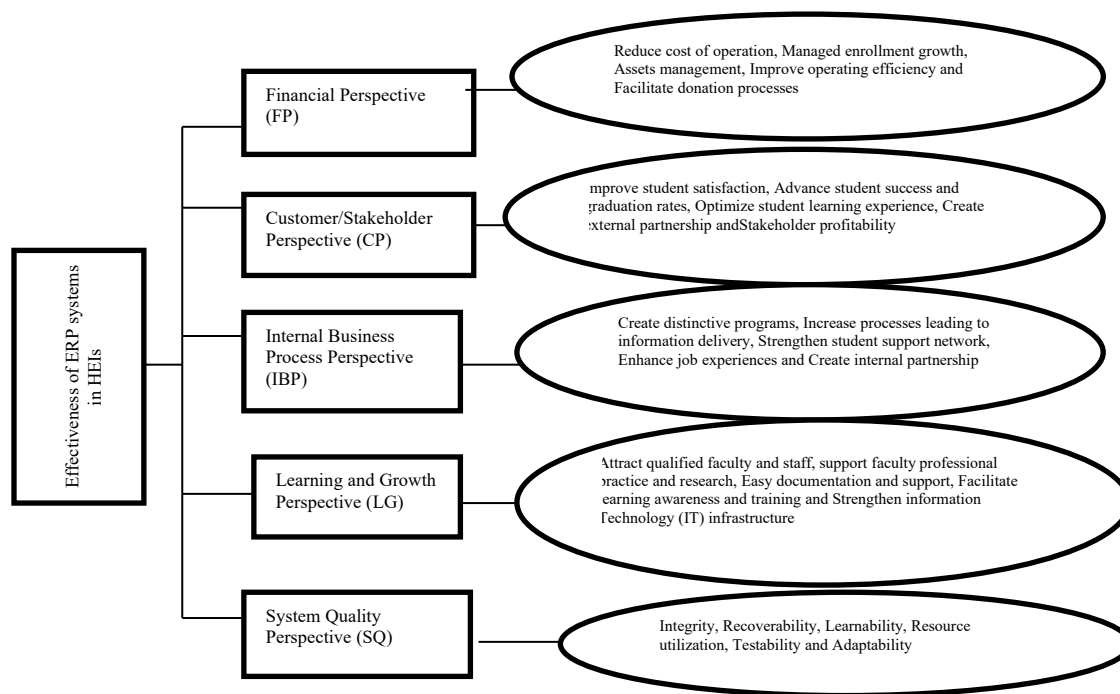


Figure 1. Proposed Analytic Framework for Evaluating ERP Systems Effectiveness, Source: Peters and Aggrey (2019)

2.2 Research Framework and Hypotheses Development

Since Peters and Aggrey (2019a) analytic framework evaluates ERP systems effectiveness in HEIs, it would be much easier using it to determine the influence of ERP systems effectiveness on management decision-making in HEIs. Their framework tells us that ERP systems effectiveness can be measured or determined with five

perspectives. In this study, we want to determine the influence that these perspectives (which are measurements of ERP systems effectiveness) would have on management decision-making in HEIs. Therefore, our proposed research conceptual model has six constructs which include financial perspective, customer/stakeholder perspective, internal business process perspective, learning and growth perspective, system quality perspective and management decision-making. Figure 2 below shows the proposed research conceptual model.

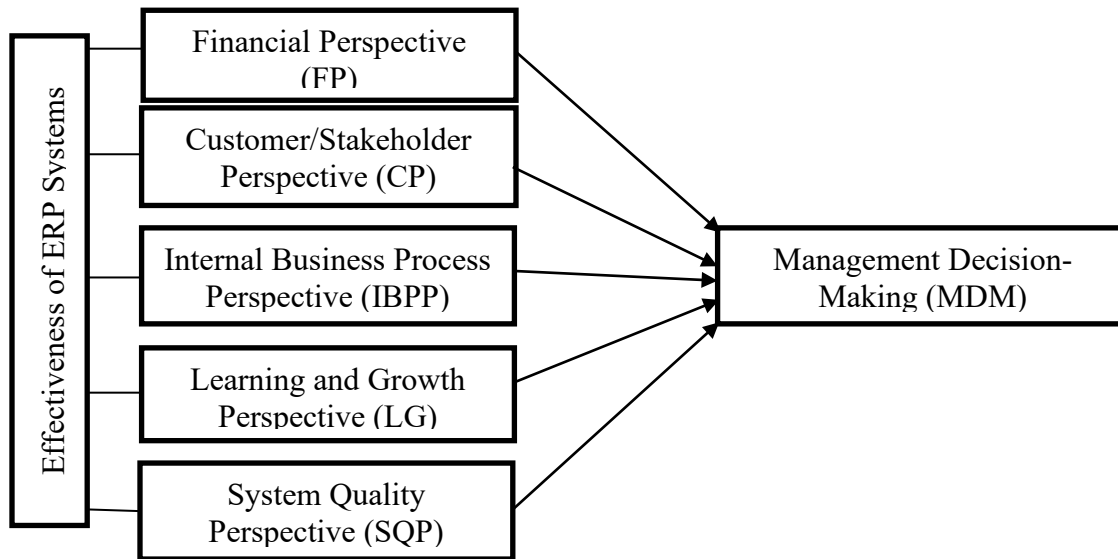


Figure 2. Research conceptual model

Financial Perspective (FP)

Indeed, several studies have reported that ERP systems support management decision-making in HEIs (Tortorella et al. 2015; Abbas, 2011; Rabaa'i et al. 2009a). ERP systems are managerial tools for managing all the resources within an organization or institution. An effective ERP system generates the necessary information needed by the management, managers and stakeholders for decision-making. Financial information such as budget report, procurement report, audit report, financial statement and cost-benefit analysis can be generated by the ERP systems. This information plays a pivoted role in management decision-making in organizations (Carton and Adam, 2005). According to Seethamraju, 2007; Bahareh et al. 2014; Milojevic et al. 2016, ERP systems generate accurate, timely and relevant information for decision-making in an organization. Since ERP systems effectiveness in HEIs support the generation of financial information or reports for management decision-making, thus we can conclude that the financial perspective of ERP systems effectiveness has some level of association with management decision-making in HEIs.

Hence, we agreed that the financial perspective of ERP systems effectiveness influence management decision-making in HEIs. We, therefore, propose the following hypothesis:

H1: ERP systems effectiveness based on financial perspective has a significant influence on management decision-making in HEIs

Customer/Stakeholder Perspective (CP)

According to Althonayan (2013) ERP systems support and improve stakeholders' performance in higher education. Students, faculty, staff, community and government engagements are possible with the integration of ERP systems in higher education. Since ERP systems effectiveness in HEIs support government, faculty and community engagements for management decision-making, then we can confidently say that customer/stakeholder perspective of ERP systems effectiveness has a positive association with management decision-making. Hence, we propose the following hypothesis:

H2: ERP systems effectiveness based on customer/stakeholder perspective has a significant influence on management decision-making in HEIs.

Internal Business Process Perspective (IBPP)

According to Parsa and Duffchahi (2015), the internal business processes perspective of ERP systems effectiveness improve decision-making in an organization. In HEIs, various activities or processes such as administrative processes, quality of teaching activities, learning processes and information management processes are all supported by the effectiveness of ERP systems. Hence, we can conclude that, the internal business process perspective of ERP systems effectiveness influence management decision-making in HEIs. We therefore, propose the following hypothesis:

H3: Effectiveness of ERP systems based on internal business process perspective has a significant influence on management decision-making in HEIs

Learning and Growth Perspective (LGP)

Parsa and Duffchahi (2015) asserted that the learning and growth perspective of ERP systems effectiveness support and improve decision-making in an organization. Since ERP systems effectiveness in HEIs support staff training and development, staff retention, and staff recruitment activities for management decision-making, thus we can conclude that the learning and growth perspective of ERP systems effectiveness has some level of association with management decision-making in HEIs. We therefore, propose the following hypothesis:

H4: ERP systems effectiveness in terms of learning and growth perspective has a significant influence on management decision-making in HEIs

System Quality Perspective (SQP)

According to Ifinedo (2011) the system quality perspective of ERP systems effectiveness produces quality information for management decision-making. Since the quality of ERP systems in HEIs ensure accuracy, reliability, security and usability of information for decision-making, then we can conclude that system quality perspective of ERP systems effectiveness has an association with management decision-making in HEIs. Thus, we propose the following hypothesis:

H5: Effectiveness of ERP systems based on system quality perspective has a significant influence on management decision-making in HEIs

Management Decision-Making (MDM)

Management Decision-Making as a construct in this study is very significant because it is a construct that this research study seeks to determine its relationship with the other constructs. According to the definitions and capabilities of ERP systems, it can be deduced that ERP systems are managerial tools for managing all the resources within an organization. In this study, management decision-making is about the decision-making with the ERP systems in HEIs. Various studies (Bahareh et al. 2014; Parsa and Duffchahi, 2015) have investigated ERP systems support to management decision-making.

3. Methodology

The research method, design and format adopted for this study are quantitative, survey and causal or explanatory research respectively, which normally test cause and effect relationship between constructs. The philosophical underpinning of this study is a positivist approach. Positivist researchers normally test quantitative data, which they generate from a population sample and later generate inferences from their results. The next section discusses the instrument development and data collection for this study.

Instrument Development

The instrument used for data collection contained scales to measure the various perspectives of the research model. There were six constructs in our research model, each of which was measured with multiple items. The questionnaire asked the respondents to rate the impact of ERP systems effectiveness (based on the five perspectives) on management decision-making using 5-point likert scale with items ranged from 1 (strongly disagree) to 5 (strongly agree). In order to improve content validity of the instrument, these items were adapted from the literature review and expert's judgment (Straub, Boudreau, and Gefen, 2004).

Measurement Instrument

The current research study's measuring instrument composes six constructs and each of which is measured with multiple items or indicators. The table 1 below shows the constructs, their measuring items and their sources.

Table 1: Constructs, measuring items, and sources

Constructs	No. of Measuring items/indicators	Sources
Financial Perspective (FP)	5	Brown (2012)
Customer/Stakeholder Perspective (CP)	5	Brown (2012)
Internal Business Process Perspective (IBPP)	5	Brown (2012)
Learning and Growth Perspective (LGP)	5	Brown (2012)
System Quality Perspective (SQP)	6	ISO 25010 Model (2011)
Management Decision-Making (MDM)	3	Lecic and Kupusinac (2013)

Source: Originated by the researcher

4. Sample and data collection

ERP experts or people who are familiar with ERP systems were used in data gathering. In this research study, administrators and managers of the universities constitute the respondents. These two groups of respondents have been selected because of their daily use and interactions with the ERP systems at the university. Concurrent mixed-method sampling which comprises probability or random technique and purposive technique was used to select the respondents from each university. A total of 180 questionnaires were sent to all the three (3) selected universities in Ghana, in which 60 questionnaires were distributed to each university. Out of this number, 164 were returned and 14 incomplete questionnaires were dropped. As a result, 150 valid responses were used for data analysis.

5. Data Analysis and Results

Partial least square approach to structural equation modelling (PLS-SEM) on SmartPLS 3 was used to analyze the data. Structural equation modelling is a powerful multivariate data analysis tool that estimates a complete model or framework through a two-step approach (Kelloway, 1998). According to Kelloway (1998), structural equation models can first be examined by assessing its measurement model for reliability and validity. After the assessment of the measurement model, then followed the structural model evaluation which tests the structural paths between the latent variables in the proposed model. This two-step approach to structural equation modelling is what has been used in this study to validate our research model or framework. PLS-SEM has been used in this study because the preliminary data analysis exhibited that the data were non-normal. SmartPLS 3 is however able to handle extremely non-normal data (Hair, 2014, p.23). It also performs bootstrapping analysis to help assess the statistical significance of the loadings and of the path coefficients (Ringle et al., 2005). In PLS approach, parameters were estimated using a resampling approach (i.e., bootstrap or jackknife) because it lacks the classical parametric inferential statistics (Wold, 1982).

5.1 Measurement Model Assessment

Three important psychometric properties have been used normally to assess the measurement model in PLS-SEM. These are reliability of constructs, convergent validity and discriminant validity. Reliability of constructs in this study was assessed using cronbach's alpha and composite reliability measures to test for the internal consistency of the model. Each construct cronbach's alpha and composite reliability values exceeded the acceptable level of 0.7 as recommended by Nunnally and Bernstein (1994). It can, therefore, be concluded that the measurement model shows good reliability. Convergent validity of the model was also assessed based on two standards, as also recommended by Bagozzi and Yi (1988): (a) Average Variance Extracted (AVE) for each construct should exceed 0.5 (Fornell & Larcker, 1981) and (b) Indicator Factor Loadings should exceed 0.5 (Hair et al. 2010). We, therefore, conclude that the measurement model exhibits good convergent validity. Discriminant validity on the other hand was assessed using the Fornell-Larcker criterion, which state that the AVE of each latent construct should be greater than the highest squared correlations between any other construct (Fornell and Larcker, 1981). It is evident from table 2 that

the square root of the AVEs for each construct is greater than the cross correlation with other constructs. Based on these results, the discriminant validity of the measurement model was established.

Table 2: Discriminant validity using Fornell-Larcker Criterion

	CP	MDM	FP	IBPP	LGP	SQP
CP	0.916					
MDM	0.705	0.843				
FP	0.344	0.563	0.746			
IBPP	0.656	0.611	0.489	0.768		
LGP	0.487	0.528	0.233	0.661	0.776	
SQP	0.373	0.567	0.419	0.357	0.142	0.921

Note: Square roots of AVE shown on diagonal, while off-diagonals are inter-construct correlations.

5.2 Structural model Assessment

In order to determine the significance of each estimated path, the bootstrapping procedure was used with 5,000 resamples drawn with replacement. Coefficient of determination R², Stone-Geisser Q² and standard root mean square residual (SRMR) were determined to assess the quality of the research model. The results for the structural model assessment are presented in figure 3.

ERP systems effectiveness based on financial perspective was found to have a significant influence on management decision-making with parameters ($\beta = 0.516$, $p = 0.000$), thereby providing support for H1. Again, the effectiveness of ERP with respect to customer/stakeholder perspective was found to have a significant influence on management decision-making with parameters ($\beta = 0.613$, $p = 0.000$), providing support for H2. Contrary to expectation, the effectiveness of ERP systems based on internal business process perspective was found not to have a significant influence on management decision-making ($\beta = 0.207$, $p = 0.172$), providing no support for H3. Effectiveness of ERP with respect to learning and growth perspective was found to have a significant effect on management decision-making with parameters ($\beta = 0.432$, $p = 0.000$), thereby providing support for H4. ERP systems effectiveness based on system quality perspective was also found to have the most significant influence on management decision-making ($\beta = 0.682$, $p = 0.000$), providing support for H5.

Finally, to assess the fitness of the model in PLS we used the Stone-Geisser Q² (predictive relevance) (Geisser, 1975; Stone, 1974) and the standard root mean square residual (SRMR). Q² is a measure of how well the observed values are reproduced by the model and its estimated parameters. Q² value greater than 0 is an indicative of predictive relevance. Hence, Q² value for management decision-making in this model is 0.462, indicating predictive relevance. The SRMR value for the model was also found to be 0.070, which is far below the 0.08 threshold recommended by Hu and Bentler (1999). Therefore, the model presents a good model fit.

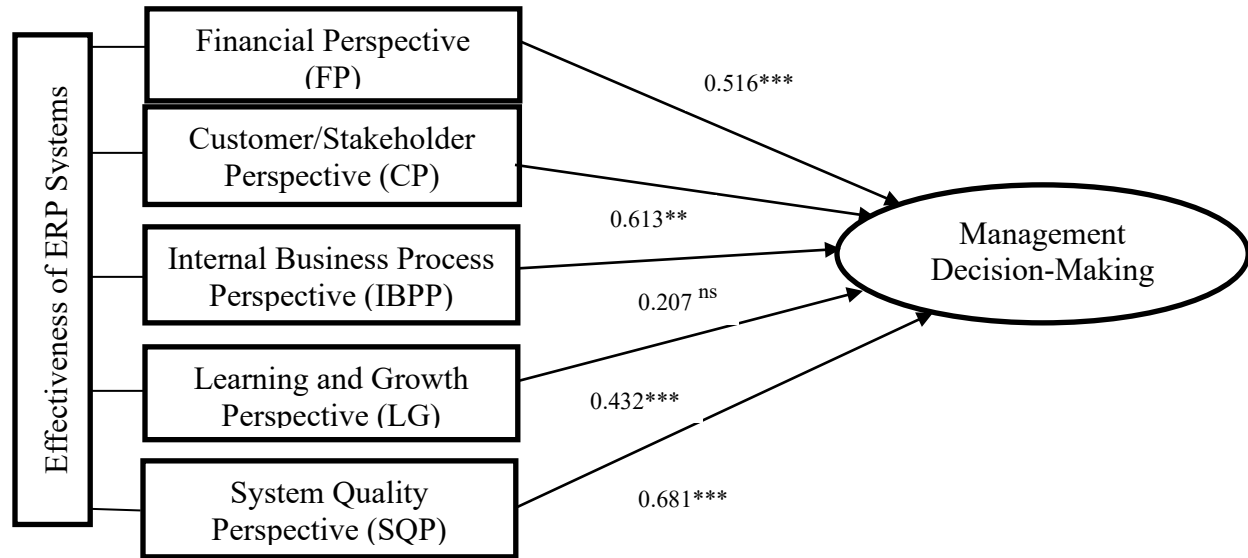


Figure 3: PLS results for structural model

Note: ns = not significant; *p < 0.05; **p < 0.01; ***p < 0.001 (2 - tailed)

6. Discussions and implications

We started our discussion of research findings by quickly reviewing our study objective. The research study's main objective was to investigate the ERP system effectiveness on management decision-making in HEIs using the adopted framework of Peters and Aggrey. Five hypotheses were tested under this objective and five findings were arrived at in this study. The findings of this study have been discussed while relating them to previous works. These have been presented as follow:

Research Objective

To investigate the ERP system effectiveness on management decision-making in HEIs using the adopted framework of Peters and Aggrey.

H1 Findings: The findings showed that ERP systems effectiveness based on financial perspective has a positive significant influence on management decision-making in HEIs.

Relation to previous studies

Other researchers (Chand et al., 2005; Parsa and Duffchahi, 2015) supported the claim that ERP system effectiveness based on financial perspective has a positive significant influence on management decision-making. The research findings also support the claim by Tsai et al., (2010) that the financial indicators such as reducing processing time, improving flow efficiency, and rapidly generating financial information contribute to the management decision-making.

H2 Findings: The findings showed that ERP systems effectiveness based on customer/stakeholder perspective has a positive significant influence on management decision-making in HEIs.

Relation to previous studies

Earlier researchers (Abugabah et al., 2013; Althonayan, 2013) supported the claim that ERP system effectiveness based on customer/stakeholder perspective has a positive significant influence on management decision-making. According to them, ERP systems impact positively on user performance or satisfaction leading to better management decision-making in the HEIs.

H3 Findings: The findings showed that ERP systems effectiveness based on internal business process perspective has no significant influence on management decision-making in HEIs.

Relation to previous studies

The works of other researchers (Carton and Adam, 2010; Seethamraju and Sundar, 2013) supported the claim that ERP system effectiveness based on internal business process perspective has no significant influence on management decision-making.

H4 Findings: The findings showed that ERP systems effectiveness based on learning and growth perspective has a positive significant influence on management decision-making in HEIs.

Relation to previous studies

Earlier studies by (Batada and Rahman, 2012, Shen et al., 2016) supported the claim that ERP system effectiveness based on learning and growth perspective has a positive significant influence on management decision-making in HEIs.

H5 Findings: The findings showed that ERP systems effectiveness based on system quality perspective has a positive significant influence on management decision-making in HEIs.

Relation to previous studies

The works of other researchers (Ifinedo, 2011; Althonayan, 2013) supported the claim that ERP system effectiveness based on system quality perspective has a positive significant influence on management decision-making in HEIs. They used the system quality perspective (system quality indicators) to evaluate or measure the effectiveness or performance of the ERP systems.

Research findings from our analysis showed that ERP systems effectiveness based on financial, customer/stakeholder, learning & growth and system quality perspectives had positive significant influence on management decision-making in HEIs. Only the internal business process perspective of ERP systems effectiveness failed to have a significant influence on the management decision-making.

7.Limitations and future research directions

There is no research study without limitations, despite its great findings and implications. These limitations, however, present directions and opportunities for future research. Firstly, the questionnaires distributed to each universities in this study were small as this may affect the generalization of our results. Moving forward, larger samples may be considered to give a balance representation of the population. Secondly, individual perspectives of ERP systems effectiveness influence on management decision-making in HEIs may be studied into details in order to understand this phenomenon. Lastly, a comparative study could be done in both public and private universities about the effectiveness of ERP systems influence on management decision-making.

8. Conclusion

In this section of the study, we recall the study's research objective and research findings. After the confirmation of research objective and its related findings, we then turned to the implications of the findings.

Research objective: To investigate the ERP system effectiveness on management decision-making in HEIs using the adopted framework of Peters and Aggrey.

Research findings:

1. Finding 1: ERP systems effectiveness based on financial perspective has a positive significant influence on management decision-making in HEIs.
2. Finding 2: ERP systems effectiveness based on customer/stakeholder perspective has a positive significant influence on management decision-making in HEIs.
3. Finding 3: ERP systems effectiveness based on internal business process perspective has no significant influence on management decision-making in HEIs.
4. Finding 4: ERP systems effectiveness based on learning and growth perspective has a positive significant influence on management decision-making in HEIs.

5. Finding 5: ERP systems effectiveness based on system quality perspective has a positive significant influence on management decision-making in HEIs.

Implications of Research Findings:

Practical implications:

- The research findings suggest that HEIs management and other stakeholders should consider critically the selection and adoption of ERP systems since decision-making by HEIs management depends on the effectiveness of ERP systems.
- Our study's findings recommend that stakeholders and HEI management should take collaborative steps to consider the ERP system vendors and their supporting services since decision-making is determined by the quality or effectiveness of ERP systems in HEIs.

Policy implications:

- The research findings suggest to HEIs management to develop and implement certain policies and frameworks that will guide and direct them to evaluate ERP systems effectiveness. These policies and frameworks will help HEIs to come up with effective ERP systems that influence management decision-making.
- The research findings recommend that HEIs management and other stakeholders take collaborative steps to develop and implement certain policies that would guide them to select and adopt ERP systems. Selecting best and effective ERP systems will help HEIs to make best decisions ever.

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