

Evaluating the factors that affect the effectiveness of ERPs in Ghanaian Higher Education: A Multiple Case Study Approach

1. Emmanuel Peters

Department of Computer Science and Information Technology
Accra Institute of Technology (AIT), Ghana
Email: peterse30@gmail.com

2. George K. Aggrey

Department of Computer Science and Information Technology
University of Cape Coast (UCC), Ghana
Email: gaggrey@ucc.edu.gh

3. Amevi Acakpovi

Department of Electrical and Electronic Engineering
Accra Technical University (ATU), Ghana
Email: aacakpovi@atu.edu.gh

Abstract

The massive investment in Enterprise Resource Planning (ERP) systems by Higher Education Institutions (HEIs) need to be evaluated in terms of the success of their application. Governments and other investors who generally foot the bills for the higher education institutions worldwide are requesting for return on their investments. However, higher education institutions find it difficult and challenging to evaluate either the financial and non-financial benefits or the tangible and intangible benefits of the ERP systems. With the increasing number of adoption and implementation of ERP systems in HEIs over the last decade, this paper adopts the analytic framework of Peters and Aggrey (BSC framework and ISO 25010 model) to evaluate the effectiveness of ERP systems in Ghanaian higher education. The purpose of this paper is to establish the significant factors for evaluating the effectiveness of ERP systems in Ghanaian higher education using the adopted analytic framework. From the literature and other studies reviewed, there is no study that has established significant factors for evaluating ERP systems effectiveness in Ghanaian higher education. Using a mixed-method research, data for quantitative analysis were collected from 173 administrators and managers of three (3) case study universities (University of Ghana, University of Cape Coast and Kwame Nkrumah University of Science and Technology) in Ghana that have implemented ERP systems for two (2) or more years. Six (6) managers from the case study universities were also interviewed for the qualitative analysis. Data were analyzed using partial least square – structural equation modeling (PLS-SEM) and inductive thematic analysis. The findings of the study revealed that financial perspective, customer/stakeholder perspective, learning and growth perspective; and system quality perspective have significant or positive association with the effectiveness of ERP systems in the Ghanaian higher education. These findings suggest that HEIs managements and other stakeholders in Ghanaian higher education should be mindful of these significant factors (the four perspectives) when evaluating ERP systems. The findings again demonstrated that the proposed research model performed well in determining the significant factors that affect the effectiveness of ERP systems in Ghanaian HEIs. Available studies about ERP systems in Ghana have focused on the implementation issues and use only, but have ignored the ERP evaluation issues. Hence, this study contributes uniquely to the phenomenon of ERP systems evaluations in the Ghanaian higher education sector.

Keywords: ERP systems, framework, Evaluation, ERP effectiveness, Balanced Scorecard

INTRODUCTION

ERP systems are described as large information systems implemented in organizations with the aim of processing and facilitating integration and real-time transactions within the organizations. ERP systems are designed to allow seamless flow of information across the entire organization and to address the problem of fragmentations of information or “Islands of information” in organizations. The higher educational institutions across the world have introduced enterprise resource planning (ERP) systems to automate and integrate their business processes, including recruitment, admission, financial aid, student records, and most academic and administrative services (Ghuman & Chaudhary, 2012). According to Rabaa'i, Bandara, and Gable (2009a), the main advantages of ERP systems for HEIs are: (1) improved information access for planning and managing the institution; (2) improved services for the faculty, students and employees; (3) lower business risks and (4) increased income and decreased expenses due to improved efficiency. Despite the difficulties and risks in adopting

and implementing ERP systems in HEIs, their use is expanding rapidly. The market of ERP systems is expected to reach \$41.69 billion in sales by 2020 (Allied Market Research, 2015). Therefore, researchers have been tasked to find appropriate methodology or frameworks to evaluate them from various perspectives.

The massive investment in ERP systems by higher education institutions need to be evaluated in terms of the success of their application. Investors, particularly governments which support most of the educational institutions in the world are now calling for better management, transparency, efficiency and evaluation from these higher education institutions. However, higher education institutions find it challenging and difficult to evaluate either the financial and non-financial benefits or the tangible and intangible benefits of the ERP systems. Due to this difficulty, Peters and Aggrey (2019a) proposed an analytic framework to evaluate the effectiveness of ERP systems in HEIs, but failed to test empirically the framework on a multiple case study approach.

Various frameworks and models have been developed for the evaluation of ERP systems (Delone and McLean, 1992, 2003; Ifinedo, et al., 2010; ISO 25010, 2011; Kaplan and Norton, 1992) but majority of these frameworks and models have all been developed to evaluate ERP systems in business organization context, thereby ignoring the higher education institutions. Pollock and Cornford (2004) have made it clear to our understanding that universities are unique organizations with some unique characteristics which are different from those of business organizations. Some of these unique characteristics are complexity of purpose, limited measurability of output, autonomy and dependency from wider society, diffuse structure of authority and internal fragmentation. Universities are different from other organizations in terms of structural and business processes, hence they required specific research attention (Pollock and Cornford, 2004; Rabaa'I, 2009). Therefore, with these unique characteristics of the universities, applying these existing frameworks and models will not help in getting the true picture of the ERP systems evaluations in the universities.

Hence, with this in mind, this present research study is designed to contribute to the literature of information systems by using the framework proposed by Peters and Aggrey (2019). This framework takes into consideration both the characteristics of ERP systems and the universities context. The theoretical framework underpinning this research study comes from a combination of a framework and a model. The framework integrates both BSC framework and ISO 25010 Model to evaluate the effectiveness of ERP systems in HEIs.

ERP SYSTEMS EVALUATION.

Enterprise resource planning (ERP) systems are complex and comprehensive software packages designed to integrate various enterprise's business processes and functions. In spite of the difficulties and risks in adopting ERP systems, their adoption and use are expanding rapidly. Therefore, researchers have attempted to find appropriate methods to evaluate them from various perspectives. Several studies (Aremu and Shahzad, 2015; Abugabah et al., 2015; Karia and Soliman, 2017 and Chaushi et al., 2018) have been conducted on ERP systems, but none has evaluated the effectiveness of ERP systems in higher education institutions (HEIs). The two most important ERP systems evaluation approaches that synthesize all the different evaluation perspectives together were discussed in the work of Zouine and Fenies (2015). The first is the AHP (Analytical Hierarchy Process) approach which assesses the relative importance weights of each ERP performance measurement; it can be used to select the main performance indicators of ERP system, and explains the contribution of ERP system in the organizational performance. The second is the BSC (Balanced Scorecard) approach which is used to understand better and classify the performance measurements of the ERP system. BSC evaluates the ERP systems from four main perspectives: financial perspective, internal business perspective, innovation/learning perspective and finally the customer perspective. This BSC framework is widely used in management science in different disciplines to assess the organizational performance.

Althonayan (2013), reports that despite the number of methodologies and frameworks proposed to evaluate ERP systems, they still present severe limitations and consistent drawbacks. The problem of evaluation of ERP systems is as a result of inappropriate methodologies and frameworks or models developed to evaluate ERP systems in most organizations. According to Irani and Love (2008), there is no good framework for assessing the impact of IS/ERP in the organization performance in the literature review and that there is no good framework for selecting the appropriate tools for IS/ERP investments. Shen et al., (2016) assert that there is no analytic framework and a rigidity approach for ERP system performance evaluation in the existing literature. These assertions have also been supported by Peters and Aggrey (2019) that there is no suitable analytic framework that would evaluate systematically the effectiveness of ERP systems in higher education institutions.

THEORETICAL BACKGROUND OF THE STUDY

The framework for this study is an adopted analytic framework of Peters and Aggrey (2019), 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.

RESEARCH FRAMEWORK AND HYPOTHESES DEVELOPMENT

The six adopted constructs identified in the proposed analytic framework of Peters and Aggrey (2019a) are used in this study as the research framework. These six constructs or variables have been discussed extensively in the previous works of Peters and Aggrey (2019a, 2019b) and currently adopted to evaluate the effectiveness of ERP systems in HEIs. Based on the previous work of Peters and Aggrey (2019a), the following constructs and hypotheses are proposed for this study:

A. *Financial Perspective (FP)*

H1: Financial perspective has a significant influence on ERP systems effectiveness in HEIs

B. *Customer/Stakeholder Perspective (CP)*

H2: Customer/stakeholder perspective has a significant influence on ERP systems effectiveness in HEIs

C. *Internal Business Process Perspective (IBPP)*

H3: Internal business process perspective has a significant influence on ERP systems effectiveness in HEIs

D. *Learning and Growth Perspective (LGP)*

H4: Learning and growth perspective has a significant influence on ERP systems effectiveness in HEIs

E. *System Quality Perspective (SQP)*

H5: System quality perspective has a significant influence on ERP systems effectiveness in HEIs

F. *Effectiveness of ERP Systems (EOES)*

Effectiveness of ERP system as a construct is very significant in this study since it is one of the construct that this research study seeks to determine its relationship with other constructs. The effectiveness of an IS can be defined as the extent to which an information system actually contributes to achieving organizational goals (Thong et.al., 1996 and Ifinedo, 2011). This study has adapted the effectiveness of ERP systems measuring indicators of Parsa and Duffchahi (2015) for the evaluation of ITS systems effectiveness in HEIs.

G. *Research Framework*

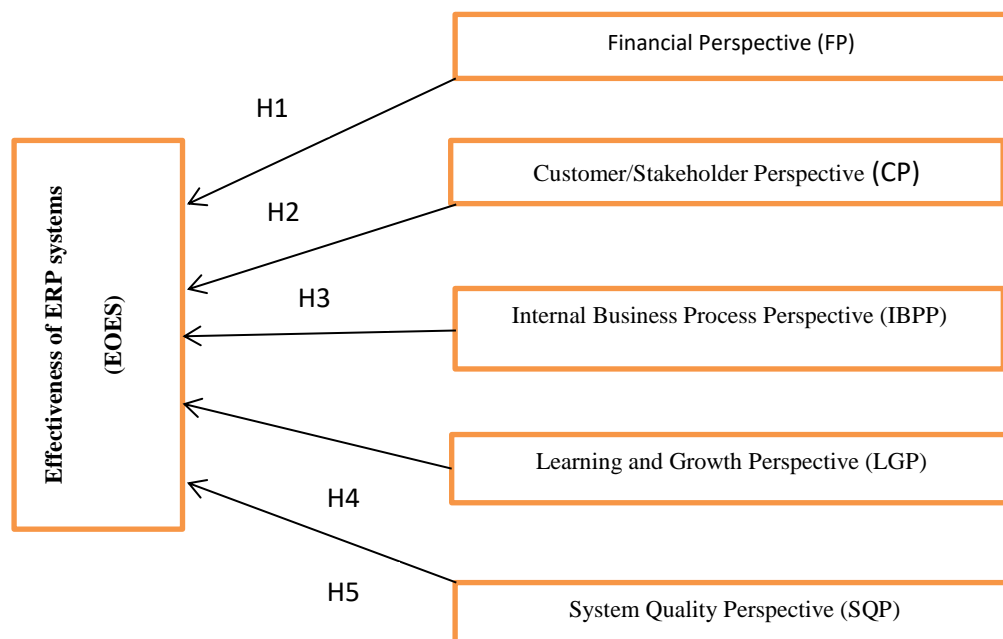


Fig 1: Proposed Analytic Framework, Source: Peters and Aggrey (2019)

METHODOLOGY

The research strategy and format adopted for this study are multiple case study and causal or explanatory research respectively, which normally test cause and effect relationship between constructs. Also the philosophical underpinning of this study is a realist approach. Realists researchers normally test for both the qualitative and 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 questionnaire asked the respondents to rate the impact of factors (perspectives) on ERP effectiveness using 5 point likert scale with items ranged from 1 (strongly disagree) to 5 (strongly agree). Five (5) structured interview questions about the constructs were also designed to be answered by the respondents.

Measurement Instrument

Measurement instrument used for the current research study composes six constructs and each of which is measured with multiple items (measuring 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)
Effectiveness of ERP Systems (EOES)	4	Parsa and Duffchahi (2015)

Source: Originated by the researcher

Case Study Universities

The study selected University of Ghana (UG), University of Cape Coast (UCC) and Kwame Nkrumah University of Science and Technology (KNUST) as its case studies in the higher education based on the following reasons:

- They have the number of respondents to be used for data collection.
- They have long term experiences with the use of ERP systems.
- They have been selected based on their convenience, proximity or closeness at hand (Kannae, 2004).
- They have all implemented a number of ERP systems modules such as Human resource module, Finance module, Academic module, etc.

Sample and data collection

A concurrent mixed-method sampling which comprises probability or random technique and purposive technique was used to select the respondents from each case study university. The technique helped to generate single sample for both quantitative and qualitative analysis. A total of 200 questionnaires were sent to all the three case study universities, in which 65 questionnaires each were sent to University of Ghana (UG) and University of Cape Coast (UCC), while 70 questionnaires were sent to Kwame Nkrumah University of Science and Technology (KNUST). Out of this number, 183 were returned and 10 incomplete questionnaires were dropped. As a result, 173 valid responses were used for data analysis in which 58 valid responses were from UG, 55 from UCC and 60 from KNUST. Of the valid responses, 107 (61.85%) were males while 66 were females, representing 38.15 percent. For the interview section, six (6) respondents (two (2) from each case study universities) were interviewed for the qualitative analysis.

Quantitative Data Analysis of Case Studies

Data collected were analyzed using the partial least square approach to structural equation modelling (PLS-SEM) on SmartPLS 3 (Ringle et al., 2015). Structural equation modelling is a powerful multivariate data analysis tool that estimates or assesses a complete model or framework through a two-step approach (Kelloway, 1998 and

Chin, 1998). According to them, 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 or framework. This two-step approach to structural equation modelling is what has been used in this study to validate our research model or framework. The current study employs PLS-SEM because preliminary 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). Also the parameters of PLS approach were estimated using a resampling approach (i.e. bootstrap or jackknife) since it lacks the classical parametric inferential statistics (Wold, 1982).

Measurement model

Measurement model in PLS-SEM can be assessed by three important psychometric properties. 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. As displayed in table 3, each construct's cronbach's alpha and composite reliability values exceeded the acceptable level of 0.7 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, 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. 2006). Table 3 once again shows evidence of convergent validity of the model. 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 4 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 3: Results of reliability and convergent validity

	CP	EOES	FP	IBPP	LGP	SQP	CA	CR	AVE
CP1	0.945	0.623	0.296	0.561	0.439	0.342	0.930	0.952	0.833
CP2	0.775	0.687	0.421	0.600	0.467	0.300			
CP3	0.944	0.580	0.214	0.599	0.427	0.333			
CP5	0.972	0.638	0.276	0.609	0.437	0.377			
EOES1	0.539	0.916	0.531	0.530	0.470	0.480			
EOES2	0.588	0.651	0.363	0.411	0.319	0.378	0.777	0.876	0.706
EOES3	0.638	0.924	0.508	0.579	0.516	0.532			
FP1	0.174	0.280	0.568	0.285	-0.030	0.333			
FP2	0.298	0.422	0.782	0.444	0.164	0.370			
FP3	0.164	0.322	0.613	0.077	0.067	0.195			
FP4	0.330	0.579	0.950	0.539	0.349	0.353	0.812	0.869	0.574
IBPP1	0.696	0.586	0.508	0.887	0.677	0.289			
IBPP2	0.374	0.302	0.444	0.576	0.251	0.208			
IBPP3	0.310	0.346	0.159	0.727	0.578	0.060			
IBPP4	0.429	0.431	0.186	0.802	0.714	0.041			
IBPP5	0.556	0.551	0.490	0.763	0.272	0.612	0.820	0.874	0.587
LGP1	0.297	0.365	0.157	0.311	0.681	0.059			
LGP2	0.447	0.496	0.250	0.643	0.895	0.098			
LGP3	0.352	0.369	0.239	0.425	0.650	0.247			
LGP4	0.359	0.218	-0.127	0.359	0.624	0.044			
LGP5	0.424	0.487	0.222	0.690	0.927	0.093	0.964	0.971	0.848
SQP1	0.330	0.485	0.287	0.303	0.174	0.913			
SQP2	0.398	0.551	0.420	0.354	0.133	0.973			
SQP3	0.334	0.451	0.349	0.301	0.026	0.914			
SQP4	0.378	0.541	0.420	0.375	0.185	0.909			
SQP5	0.215	0.511	0.426	0.260	0.125	0.840			
SQP6	0.392	0.529	0.391	0.359	0.131	0.970			

Table 4: Discriminant validity using Fornell-Larcker Criterion

	CP	EOES	FP	IBPP	LGP	SQP
CP	0.913					
EOES	0.700	0.840				
FP	0.338	0.562	0.744			
IBPP	0.654	0.610	0.489	0.758		
LGP	0.490	0.527	0.230	0.660	0.766	
SQP	0.372	0.558	0.418	0.355	0.142	0.921

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

Structural model:

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 R^2 , Stone-Geisser Q^2 and standard root mean square residual (SRMR) were determined to assess the quality of the model or framework. The results for the structural model assessment are presented in table 5 and figure 2.

Financial perspective was found to have a direct significant influence on effectiveness of ERP systems with parameters ($\beta = 0.282$, $p = 0.010$), thereby providing support for H1. Again, customer/stakeholder perspective was found to have a significant influence on effectiveness of ERP systems with parameters ($\beta = 0.425$, $p = 0.003$), providing support for H2. Contrary to expectation, internal business process perspective was found not to have a significant influence on effectiveness of ERP systems ($\beta = -0.079$, $p = 0.585$), providing no support for H3. Learning and growth perspective was found to have a direct significant effect on effectiveness of ERP systems with parameters ($\beta = 0.267$, $p = 0.013$), thereby providing support for H4. System quality perspective was found to have the most significant influence on effectiveness of ERP systems ($\beta = 0.272$, $p = 0.001$), providing support for H5.

Finally, to assess the fitness of the model in PLS we used the Stone-Geisser Q^2 (predictive relevance) (Geisser, 1975; Stone, 1974) and the standard root mean square residual (SRMR). Q^2 is a measure of how well the observed values are reproduced by the model and its estimated parameters. Q^2 value greater than 0 is an indicative of predictive relevance. Hence, Q^2 value for effectiveness of ERP systems in this model is 0.425, indicating predictive relevance. The SRMR value for the model was also found to be 0.073, which is far below the 0.08 threshold recommended by Hu and Bentler (1999). Therefore, the model presents a good model fit.

Table 5: Path coefficients and their significance

Hypotheses	Hypothesized Path	Standard path coefficient	T Statistic	P Value	Result
H1	FP→EOES	0.282 *	2.579	0.010	Supported
H2	CP→EOES	0.425 **	2.927	0.003	Supported
H3	IBPP→EOES	-0.079ns	0.547	0.585	Not Supported
H4	LGP→EOES	0.267 *	2.476	0.013	Supported
H5	SQP→EOES	0.272 **	3.266	0.001	Supported
Coefficient of determination R^2					0.700
Stone-Geisser Q^2					0.425
SRMR					0.073

Note: ns = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

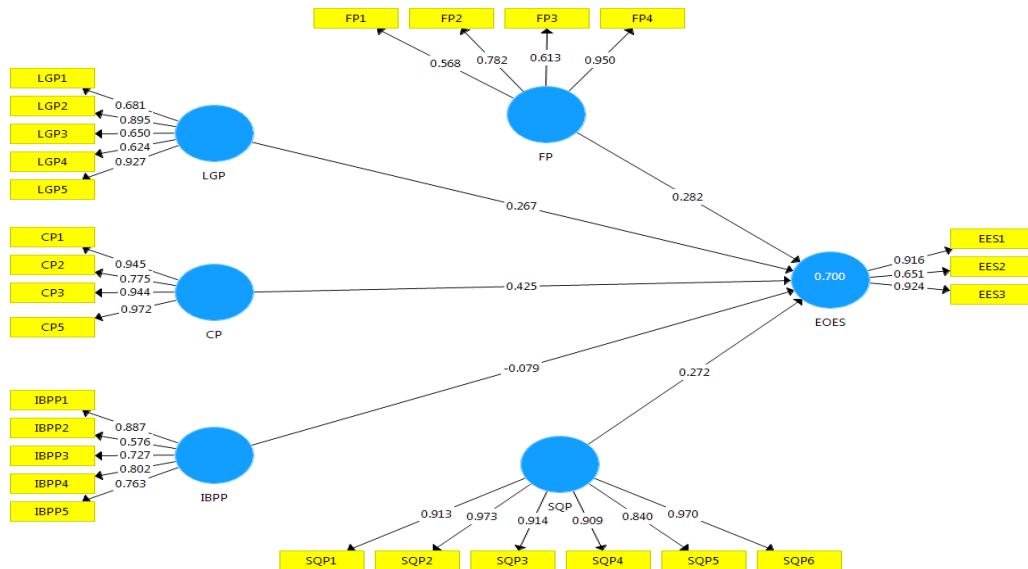


Figure 2: PLS results for structural model

Qualitative Data Analysis of Case Studies

Data collected by qualitative method (interviews) were analyzed using inductive thematic analysis. According to Braun and Clarke (2006) thematic analysis is “a method for identifying, analyzing and reporting patterns within data”. Inductive thematic analysis was chosen by the researchers to help derive meaning from the patterns of qualitative data set to enhance and validate results of the quantitative analysis.

Case Study 1: University of Ghana

ITS software system is the ERP system used by the University of Ghana. ITS system integrates the finance, human resource, students and space modules of the university. The interview with a manager and an administrator about the ITS system focused on the following specific points or themes:

Financial perspective of ERP systems effectiveness

Manager interviewed stated that:

The ITS system has really enabled the university to prepare its budget statements, procurement and purchasing reports. It has also helped to generate management and financial statements as and when needed by the managements (Manager).

Administrator interviewed asserted that:

The ITS system has a link to the student portal that makes it easy for students to pay their fees anywhere in Ghana through specific banks. It has also helped to reduce cost of operations, processing of payroll and asset management (Administrator).

Customer/Stakeholder perspective of ERP systems effectiveness

Administrator interviewed asserted that:

The staffs of the university (academic and non-academic staff) have the direct use of the ITS system; they can check their electronic payslips, apply for leave online, and upload students marks into the system. With the ITS system, students can register for courses online, assess their lecturers, check results and graduation status (Administrator).

Internal business process perspective of ERP systems effectiveness

Manager interviewed stated that:

There are certain internal processes and activities of the system that have reports or statements readily generated in the format you want. There are also certain processes and activities which no reports can be generated from the system. Therefore, ITS as a system cannot satisfy all our needs for us (Manager).

Learning and growth perspective of ERP systems effectiveness

Administrator interviewed asserted that:

Vendor training sections were organized for us after the system was first implemented, but since that time training and development sections have not been regularly organized for us. We need both short and long term training courses that will help us develop our capabilities on the use of the system (Administrator).

System quality perspective of ERP systems effectiveness

Manager interviewed stated that:

The ITS system is more user-friendly, easy to learn, easy to recover data and information during emergency situations and easy to navigate your way through. ITS is not a complex and difficult software system to learn and use. It comes with a simple graphical user interface (GUI), that you can easily use (Manager)

Administrator interviewed asserted that:

ITS system provides our data and information with the security we need. The system comes with strong security features that have prevented many people from getting into the system through backdoor. ITS system comes with a web-based interface that help us to work both inside and outside the university (Administrator).

Case Study 2: University of Cape Coast

Topaz software system is the ERP system used by the University of Cape Coast. Topaz ERP system integrates both the finance and human resource departments of the university and has been implemented for the past five years. The interview with a manager and an administrator about the topaz system focused on the following specific points or themes:

Financial perspective of ERP systems effectiveness

Manager interviewed stated that:

Topaz system has really enabled the university to manage its investment portfolios, generate management and financial reports as and when needed by the management (Manager).

Administrator also interviewed asserted that:

Topaz system has helped us to reduce cost of operations, manage students fees payments and detections of financial omissions such as overpayments and underpayments of certain goods and services (Administrator)

Customer/Stakeholder perspective of ERP systems effectiveness

Administrator interviewed asserted that:

The staffs of the university (academic and non-academic staff) do not have the direct use of the topaz system; they only receive their electronic payslips from the system through their email addresses (Administrator).

Internal business process perspective of ERP systems effectiveness

Manager interviewed stated that:

Because the topaz system is not a web-based system, working remotely is a challenge since you cannot access the system anywhere to do your work. To work with the topaz system you must have a connection to the server hosting the software system or you must have the software system installed on your computer (Manager).

Learning and growth perspective of ERP systems effectiveness

Administrator interviewed asserted that:

Vendor training was done for us initially after the system was implemented, but since that time no other training and development section has been organized for us. We need short training courses to develop ourselves capabilities on the use of the system (Administrator).

System quality perspective of ERP systems effectiveness

Manager interviewed stated that:

Topaz systems are more user-friendly, easy to learn and easy to navigate your way through. It is not a complex and difficult software system to learn and use. It comes with a simple graphical user interface (GUI), that you can easily use (Manager)

Administrator interviewed asserted that:

With topaz system our data and information are well secured from intruders. The system comes with strong security features that have prevented many people from getting into the system through

backdoor. The only challenge to topaz system quality is the absent of web-interface module (Administrator).

Case Study 3: Kwame Nkrumah University of Science and Technology

KNUST software system is an in-house software system developed by the University. The system integrates finance, human resource and various academic departments of the university. The system consists of ARMIS, Panacea, and Synergy systems. The interview with a manager and an administrator about the KNUST system focused on the following specific points or themes:

Financial perspective of ERP systems effectiveness

Manager interviewed stated that:

KNUST system comes with a financial management information system known as panacea. This module manages all the budgeting, inventory and assets of the university. Panacea also has a fee collection API which is integrated with banks in the country in order for students to pay their school fees (Manager).

Administrator interviewed asserted that:

The panacea system has helped us to reduce cost of operations, manage payroll issues and generate complex reports such as financial and management reports (Administrator)

Customer/Stakeholder perspective of ERP systems effectiveness

Administrator interviewed asserted that:

With the KNUST system, lecturers can upload their examination marks; staff members can apply for leave online, apply for promotions and check their retirement status. The system doesn't provide any link to external affiliate institutions (Administrator).

Internal business process perspective of ERP systems effectiveness

Manager interviewed stated that:

KNUST system is not a cross-platform based system so users using different operating systems other than windows operating systems would encounter challenges in accessing the system. So to work perfectly with KNUST software systems you must have windows operating systems installed on your machine (Manager).

Learning and growth perspective of ERP systems effectiveness

Administrator interviewed asserted that:

Regular training sections have been organizing for us since the system was first introduced. Regular support to the system has also been fort coming, making the system more robust and effective. There is also the need for both short and long term training courses that will help us develop our capabilities on the use of the system (Administrator).

System quality perspective of ERP systems effectiveness

Manager interviewed stated that:

KNUST systems are more user-friendly, easy to learn, easy to recover data and information during emergency situations and easy to navigate your way through. Again, the systems are not complex and difficult to learn and use. It comes with a simple graphical user interface (GUI), that you can easily use (Manager)

Discussions and implications

Studies that examine ERP systems effectiveness have all been done in the context of business organizations. By examining the determinants of ERP systems effectiveness in the Ghanaian higher education, we add new insight into the existing literature by offering a better theoretical understanding of ERP systems effectiveness in general. Although the Ghanaian higher education is rapidly adopting and implementing ERP systems, very little is known about its effectiveness evaluations. In this regard, our study extends knowledge on ERP systems evaluation in the context of Ghanaian higher education. The study examines the influences of financial perspective, customer/stakeholder perspective, internal business process perspective, learning and growth perspective and system quality perspective on ERP systems effectiveness in Ghanaian higher education. The findings of the study showed that financial perspective, learning and growth perspective, customer/stakeholder perspective, and system quality perspective have significant or positive association with the effectiveness of ERP systems in the Ghanaian higher education. Internal business process perspective failed to have a significant influence on the effectiveness of ERP systems in the Ghanaian higher education context. One practical implication from these findings suggest that when it comes to the evaluation of ERP systems effectiveness in higher education,

especially in the Ghanaian higher education context financial, learning and growth, customer/stakeholder and system quality perspectives play important roles which cannot be ignored by the entire evaluation team.

Limitations and future research directions

Despite the study's interesting findings and implications, it is not without limitations. These limitations, however, present directions and opportunities for future research. Firstly, this research included only five specific factors based on prior research works. There may be additional factors which determine or influence ERP system effectiveness in HEIs that were not examined in this study. Secondly, there are other evaluation models or frameworks that can be integrated to study ERP systems effectiveness in HEIs. Thirdly, cross-sectional and longitudinal surveys can also be used to study the effects of these constructs on ERP systems effectiveness in HEIs. Lastly, we suggest researchers investigate ERP systems effectiveness in HEIs by comparing results from developed nation to developing nation.

References

- Abugabah, A., Sanzogni, L. and Alfarraj, O. (2015), "Evaluating the impact of ERP systems in higher education", *International Journal of Information and Learning Technology*, Vol.32 No. 1, pp. 45-64. Allied Market Research, 2015
- Althonayan, M. (2013) "Evaluating Stakeholders Performance of ERP Systems in Saudi Arabia Higher Education", Ph.D. Thesis, Department of Information Systems and Computing, Brunel University.
- Aremu, A.Y. and Shahzad, A. (2015) "Enterprise Resource Planning (ERP) Intention to Use for Decision Making Purpose in Higher Education Institutions in Nigeria" *International Journal of Management and Social Sciences Research (IJMSSR)* ISSN: 2319-4421 Volume 4, No. 4, April 2015
- Bagozzi, R.P., and Yi, Y. (1988) "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, 16(1), 74-94.
- Braun, V. and Clarke, V. (2006) "Using thematic analysis in psychology", *Qualitative Research in Psychology*, 3, pp.77-101.
- Brown, C. (2012) "Application of the Balanced Scorecard in Higher Education Opportunities and Challenges", An evaluation of balance scorecard implementation at the College of St. Scholastica.
- Chaushi, B.A., Chaushi, A., and Ismaili, F. (2018) "ERP systems in higher education institutions: Review of the information systems and ERP modules," 2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, 2018, pp. 1487-1494,
- Chin, W.W., (1998) "The partial least squares approach to structural equation modeling", *Modern Methods for Business Research*, 295(2), 295-336.
- Delone, W.H. and Mclean, E.R. (1992) "Information systems success: The quest for the dependent variable", *Information systems research*, 3 (1), pp.60-95.
- Delone, W. H. and Mclean, E.R. (2003) "The Delone and Mclean model of information systems success: A ten-year update", *Journal of management information systems*, 19 (4), pp.9-30.
- Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurements error", *Journal of Marketing Research*, Vol. 18, Feb, pp.39-50.
- Geisser, S. (1975) "The predictive sample reuse method with applications", *Journal of the American Statistical Association*, Vol. 70 No. 350, pp. 320-328.
- Ghuman, K.; Chaudhary, S. (2012) "Incorporation of ERP in Educational Institutions: An Empirical Study", *International Conference on Technology and Business*
- Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., & Tatham, R.L. (2006). "Multivariate data analysis, New Jersey, NJ: Prentice Hall.
- Hair, J.F., Hult, T.M., Ringle, C. and Sarstedt, M. (2014). "A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), Sage Publications, Thousand Oaks, CA.
- Hu, L. and Bentler, P.M. (1999). "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 6 No. 1, pp. 1-55.
- Ifinedo, P., Birger, R., Ifinedo, A., and Sundberg, K. (2010) "Relationships among ERP post implementation success constructs: an analysis at the organizational level," *Computers in Human Behavior*, vol. 26, no. 5, pp. 1136-1148
- Ifinedo, P., 2011. "Examining the influences of external expertise and in-house computer/IT knowledge on ERP system success". *Journal of Systems and Software* 84, 2065-2078.
- Iran, Z., Love, P.E.D., (2008) "Evaluating information systems public and private sector" Elsevier
- ISO/ IEC CD 25010 (2008) "Software Engineering: Software Product Quality Requirements and Evaluation (SQuaRE) Quality Model and guide". International Organization for Standardization, Geneva,

- Switzerland.
- Kaplan, R. S., and Norton, D. P (1992) "The Balanced Scorecard: Measures that drive performance". Harvard Business Review, pp. 172-180.
- Karia, N. and Soliman, M. (2017) "Factors affecting enterprise resource planning (ERP) systems adoption among higher education institutions in Egypt," INTERNATIONAL JOURNAL OF ADVANCED AND APPLIED SCIENCES, vol. 4, p. 8, May 2017.
- Kelloway, E. (1998). "Using LISREL for structural equation modeling: A researcher's guide", Sage Publications, Inc.
- Nunnally, J. and Bernstein, I. (1994). "Psychometric Theory", 3rd ed., McGraw-Hill, New York, NY.
- Parsa, K. and Duffchahi, N. (2015) "Evaluating the effectiveness of enterprise resource planning (ERP) system to improve managers' decision-making through balanced scorecard approach", Journal of Applied Environmental and Biological Sciences www.textroad.com.
- Peters, E., & Aggrey, G. K. (2019, March). "Evaluating the Effectiveness of ERP Systems in HEIs: A Proposed Analytic Framework". In 2019 International Conference on Computing, Computational Modelling and Applications (ICCA) (pp. 40-405). IEEE.
- Pollock, N. and Cornford, J. (2004) "ERP System and the university as a 'unique' organization" Information Technology & People, 17 (1), pp. 31-52.
- Rabaa'i, A.; Bandara, W.; Gable, G. (2009a) "ERP systems in the higher education sector: a descriptive study", Proceedings of the 20th Australasian Conference on Information Systems, pp. 456-470,
- Rabaa'i, A. (2009b) "Identifying critical success factors of ERP systems at the higher education sector", In ISIICT 2009: Third International Symposium on Innovation in Information & Communication Technology, 15 - 17 December, 2009, Philadelphia.
- Ringle, C.M., Wende, S. and Becker, J.M. (2015). "SmartPLS 3. Boenningstedt: SmartPLS GmbH", available at: www.smartpls.com
- Ringle, C. M., Wende, S. & Will, A. 2005. SmartPLS 2.0.M3 (beta), Hamburg, University of Hamburg.
- Shen, Y., Chen, P., Wang, C. (2016) "A study of enterprise resource planning (ERP) system performance measurement using the quantitative balanced scorecard approach", Computers in Industry 75 (2016) pp.127–139
- Stone, M. (1974), "Cross-validated choice and assessment of statistical predictions", Journal of the Royal Statistical Society. Series B (Methodological), Vol. 36 No. 2, pp. 111-147.
- Straub, D., Boudreau, M.C. and Gefen, D. (2004), "Validation guidelines for IS positivistic research", Communications of the Association for Information Systems, Vol. 13 No.1, pp. 380-427.
- Thong J.Y.L., Yap, C. & Raman, K.S. (1996). "Top Management Support, External Expertise and Information Systems Implementation in Small Businesses". Information Systems Research, 7(2), pp.248 – 267.
- Wold, H.O.A. (1982), "Soft modelling: The basic design and some extensions. In K. G. Joreskog, & H.O.A. Wold (Eds.), Systems under indirect observation. Causality, structure, prediction: Part II (pp. 1-54). Amsterdam: North-Holland.
- Zouine, A & Fenies, P, (2014), "The Critical Success Factors of the ERP Project: A Meta-Analysis Methodology", Journal of Applied Business Research, Vol. 30(5).

Appendix

Financial perspective and indicators: Adapted from Kaplan (2010) and Brown (2012)

1. The ERP system has helped us to reduce cost of operations
2. The ERP system has helped to facilitate enrollment growth of the university
3. The system has assisted us to manage our investments and assets
4. The system has brought tremendous efficiency in our financial and management reporting
5. Donations from alumnus and donor partners have been facilitated by the system

Customer/stakeholder perspective and indicators: Adapted from Kaplan (2010) and Brown (2012)

1. The system has assisted students to register courses online, check their results and assess their lecturers
2. The ERP system has helped students to graduate on time without any backload of students
3. It has helped to optimize learning experiences among students
4. Relationships with the government and affiliate institutions have been improved with ERP
5. ERP system has enabled staff members to check their payroll information, apply for leave, apply for promotions and retirement issues

Internal business process perspective and indicators: Adapted from Kaplan (2010) and Brown (2012)

1. The system has assisted us to create new innovative programs and activities
2. The system has improved processes and activities leading to the delivery of information

3. Students support network has been strengthened with ERP systems
4. With the ERP system, multiple tasks can be handled and to generate different formats of report
5. ERP systems help in the internal communications among various units or departments

Learning and growth perspective; and indicators: Adapted from Kaplan (2010) and Brown (2012)

1. Because of the software system the university is using, various qualified faculty and staff members have been retained
2. The system supports faculty professional practice and research
3. The system comes with easy documentations and supports
4. The system has helped me to learn excel, access and other software applications to develop my skills
5. ERP system has assisted to improve and manage information technology (IT) infrastructure

System quality perspective and indicators: Adapted from Kaplan (2010) and Brown (2012)

1. The ERP system provides security to our data and information
2. In the event of any disaster, data and information can easily be recovered
3. It is easy to learn and use the ERP system
4. Time and effort are not wasted in the system
5. Changes or modifications can be made in the system without affecting or introducing defects into the system
6. The system can easily be moved to different hardware platforms or environments for other operations

Effectiveness of ERP system and indicators: Adapted from Parsa and Duffchahi (2015)

1. ERP system makes information available to its users
2. ERP system helps to integrate processes within the organization or the institution
3. The system prevents parallel or similar operations of activities within the organization or the institution
4. ERP system prevents entering of duplicate records of data and information