

# Assessing the Integrated Tertiary Software Systems Effectiveness in HEIs: A Case Study of a Ghanaian University

Emmanuel Peters<sup>1</sup>, George Kwamina Aggrey<sup>2</sup>, Amevi Acakpovi<sup>3</sup>

Computer Science and Information Technology<sup>1,2</sup>

Electrical and Electronic Engineering<sup>3</sup>

Accra Institute of Technology, Accra-North, Ghana<sup>1</sup>

University of Cape Coast, Cape Coast, Ghana<sup>2</sup>

Accra Technical University<sup>3</sup>

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**Abstract:** Integrated Tertiary Software (ITS) systems are popular ERP systems used in some higher education institutions in the world. ITS has gained popularity in some part of the world through its massive adoption in higher education institutions. Despite the rapid adoption and implementation of ITS systems in HEIs, there is little known in literature about their effectiveness. Thus, it is important to investigate whether these systems deliver on their predetermined benefits or not. The purpose of this paper is to assess the effectiveness of ITS systems in higher education institutions through a system integrative approach. Using a mixed-method research, data for quantitative and qualitative were collected and 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, and system quality perspective have significant influence or positive relationship with the effectiveness of ITS systems evaluation in the Ghanaian higher education. The findings again, revealed that internal business process and learning and growth perspectives have no significant influence with the effectiveness of the ITS systems in the Ghanaian context. In Ghana, studies based on ERP systems evaluations are not available. The ITS system of the university has successfully been evaluated and has proven very effective with the research model.

**Keywords:** ERP Systems, ITS Systems, ERP Effectiveness, Balanced Scorecard, High Education Institutions.

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## I. INTRODUCTION

Integrated Tertiary Software (ITS) as an Enterprise Resource Planning (ERP) system provides a comprehensive business solutions to higher education institutions. It integrates all functional units and departments within an institution or university, so that information can flow and prevent duplications of data. Many higher education institutions around the world have adopted and implemented ITS systems to automate aspects of the student life cycle and to help faculty members manage their teaching and administrative task. Despite the rapid adoption and implementation of these systems, there are still challenges with regard to its implementation in HEIs. With the high cost of implementing these systems, many governments and individual investors are calling for their return on investments (ROI).

Many HEIs have implemented ITS systems for many years but due to unknown reasons these systems are yet to be evaluated. Thus, it is mandatory to evaluate ITS systems to know which aspects of them are performing well and which aspects are not doing well. This will help the management of the institutions to plan toward future use and management of the system. Therefore, this paper aim to evaluate the ITS systems effectiveness in HEIs through a system integrative approach.

## II. ITS SYSTEMS

Integrated Tertiary Software (ITS) is a company that was established in 1986 and the only South African provider of enterprise resource planning (ERP) software to support all major administrative functions of higher education institutions. Currently, ITS has a majority market share in the southern African tertiary education administrative software market. The client base of ITS system includes more than 40 tertiary institutions worldwide of which 29 are South African based. These institutions range from fairly small institutions with approximately 2 500 students, to some of the largest institutions. Integrated Tertiary Software (ITS) system is said to have capabilities that include admission management, attendance management, tuition/fee management, student information/records system, faculty management, student portal and course management.

ITS as an ERP system comes with some modules which include financial, human resource, academic management, asset management, inventory management and space management. All these modules are fully integrated and web-enabled. Strategic statistical and management information can be extracted on an ad hoc basis from these systems for planning and coordination.

### A. Application of the ITS System

Currently, it is being used in the University of Ghana, Legon. The ITS system is used at the administration and academic sections of the university, and is an enterprise resource planning (ERP) software acquired from South Africa. The system comes with the modules which include finance, human resource, academic management and space management modules. These modules are well integrated to provide management to both administration and academic sections of the university. At the administration section, the ITS system provides finance, human resource and spatial management modules. For academic management the ITS system provides student portal management, student record management, faculty management, course management and student graduation management.

The ITS system for the past three or more years of its use in the university has not seen any major setback. Even though as a system there may be some challenges, care has been taken to address those challenges when they arise. Evaluations must therefore be done frequently to unearth challenges so that managements can find appropriate solutions to improve the system.

## III. THEORETICAL BACKGROUND OF THE STUDY

The framework for this study is an adopted analytic framework of Peters and Aggrey (2019a), which integrated the BSC framework and ISO 25010 Model for the evaluation of ERP system effectiveness in HEIs. That framework comes with five perspectives or constructs (representing independent variables) and one construct (representing dependent variable) which were used to evaluate the effectiveness of ERP systems in HEIs. There were twenty-six (26) indicators proposed in that framework to measure the five perspectives or constructs.

### A. Balanced Scorecard (BSC) Framework

The Balanced Scorecard (BSC) framework, introduced by Kaplan and Norton (1992), is well-known as one of the most popular methods in performance evaluation. The cardinal purpose of BSC is to replace or overcome the inadequacies of the traditional financial-based performance measurement tools. The first and the original use of the BSC framework was performance measurement (Kaplan and Norton, 1992). When BSC is used to measure performance, the focus is on the four performance metrics— financial, learning and growth, customer, and internal process metrics. By evaluating the four metrics, the BSC assists companies to track all the important aspects of a company's strategy as well as achieve continuous improvement of partnership and teamwork (Brown, 2012). Kaplan (2010) BSC framework revealed four perspectives and their measuring indicators. These four perspectives were defined by Kaplan in questions form as follows:

1. Financial Perspective (How do we look to shareholders?)
2. Customer Perspective (How do customers see the organization or the institution?)
3. Internal Business Process (What must we excel at?)
4. Innovation and Learning Perspective (Can we continue to improve and create value?)

### B. ISO 25010 Model

ISO 25010 is an international standard for software quality evaluation. It was originally presented in 1991 and it had been revised and extended in 2007, 2011 and 2017. According to ISO/IEC 25010 (2011), the ISO 25010 quality model is also

known as SQuaRE (Systems and software Quality Requirements and Evaluation) model. Therefore, this model evaluates the quality of both systems and software. In this respect, the model presents such quality attributes as a hierarchical structure of characteristics and sub-characteristics. The highest levels comprise eight (8) characteristics that are further divided into thirty- one (31) sub-characteristics on the lowest levels. The main significant of this model is that the model could be applied to the quality of any software product (Fahmy et al. 2012).

#### IV. 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 assess the effectiveness of ITS 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 ITS systems effectiveness in HEIs

**B. Customer/Stakeholder Perspective (CP)**

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

**C. Internal Business Process Perspective (IBPP)**

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

**D. Learning and Growth Perspective (LGP)**

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

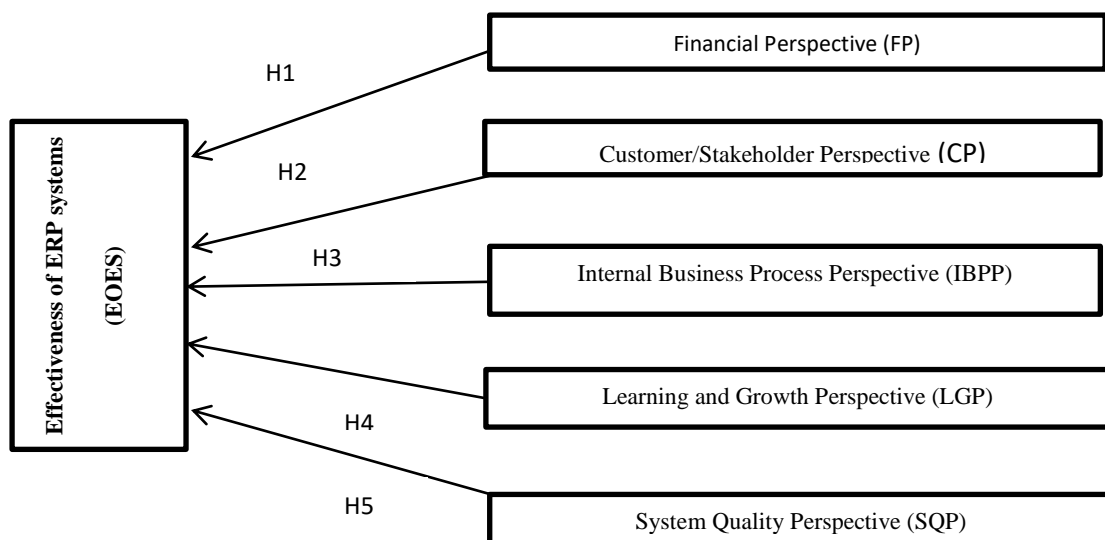
**E. System Quality Perspective (SQP)**

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

**F. Effectiveness of ERP Systems (EOES)**

Effectiveness of ERP system as a construct in this study is very significant; in the sense that it is one of the construct that this research study seeks to determine its relationship with other constructs. Effectiveness of ERP system in information system concept is about goal achievement and resource utilization. The achievement of the objectives is what effectiveness is all about. 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 (2019a)**

## V. METHODOLOGY

Since the research format is causal or explanatory research which normally test cause and effect relationship between constructs, the philosophical underpinning of this study is realist assumption. 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.

### A. Instrument Development

The instrument used for data collection contained scales to measure the various perspectives of the research model or framework. The research model included six constructs or variables, each of which is measured with multiple items. The questionnaire asked the respondents to rate the impact of factors (perspectives) on ERP effectiveness using 5 point likert scale with items ranging 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. In order to improve content validity of the instrument, these items were adapted from the literature and experts judgment (Straub, Boudreau, and Gefen, 2004). The items were reworded to reflect the context of ERP systems in higher educational sector. Also, to ensure face validity, five experienced ERP professionals from both industry and academia moderated the questionnaire.

### B. Measurement Instrument

Measurement instrument used for the current research study consist of six constructs; each of which is measured with multiple items (measuring indicators). The table 1 below shows the constructs, their measuring items and their sources.

**TABLE I: 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

### C. Case Study University

This study has adopted a case study approach to investigate the evaluation of ITS systems effectiveness in HEIs. ERP systems evaluation is a phenomenon which is uncommon in higher education institutions. Despite the increasing adoption of ERP systems in HEIs, their evaluations have not well been understood. Research about ERP systems evaluations in HEIs has also been scanty. Therefore, to understand the details of ERP systems evaluations in HEIs, frequent case study researches are needed. This study has selected University of Ghana (UG) as its case study in the higher education based on the following reasons:

- Long term experiences with the use and management of ITS systems, which will make the experts (respondents) to provide an objective evaluation of the system.
- To provide the researchers with rich data and information for their analysis of results.

### D. Sample and Data Collection

Since ERP systems evaluations are complex and technical in nature, it is required of experts or people who are familiar with these systems to do data gathering. In this research study, administrators and managers of the case study university constitute the respondents. These two groups of respondents have been selected because of their routine use and interactions with the ERP systems at the university. A concurrent mixed-method sampling which comprises probability or random technique and purposive technique was used to select the respondents from the case study university. The technique helped to generate single sample for both quantitative and qualitative analysis. Out of this, 57 valid responses were used for the analysis. Of the valid responses 65 percent were males while females represented 35 percent. For the interview section, two (2) respondents were interviewed for the qualitative analysis. Table II shows the detailed sample demographics of our respondents.

TABLE II: DEMOGRAPHIC INFORMATION OF THE SAMPLE

University of Ghana				
Case	Correspondent	Department or Unit	System	Gender
Case Study: University of Ghana	1 – 15 (15)	Finance	ITS System	Male:
	16 – 25 (10)	Human Resource		65%
	26 – 40 (15)	Academic Affairs		Female:
	41 – 50 (10)	Procurement		35%
	51 – 57 (7)	Payroll		

Source: Originated by the researcher

## VI. 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).

### A. Case Study: University of Ghana

#### 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 III, 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 III 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 states 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 IV 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 III: RESULTS OF RELIABILITY AND CONVERGENT VALIDITY

	CP	EOES	FP	IBPP	LGP	SQP	CA	CR	AVE
CP1	<b>0.945</b>	0.616	0.406	0.579	0.429	0.351	<b>0.928</b>	<b>0.950</b>	<b>0.828</b>
CP2	<b>0.764</b>	0.667	0.603	0.580	0.470	0.286			
CP3	<b>0.944</b>	0.572	0.378	0.607	0.431	0.342			
CP5	<b>0.972</b>	0.626	0.416	0.626	0.441	0.385			
EOES1	0.541	<b>0.934</b>	0.864	0.557	0.460	0.485	<b>0.781</b>	<b>0.877</b>	<b>0.710</b>
EOES2	0.592	<b>0.617</b>	0.421	0.398	0.323	0.390			
EOES3	0.639	<b>0.937</b>	0.780	0.628	0.505	0.536			
FP1	0.533	0.806	<b>0.858</b>	0.554	0.467	0.491	<b>0.775</b>	<b>0.859</b>	<b>0.671</b>
FP2	0.307	0.432	<b>0.748</b>	0.476	0.168	0.384			

FP4	0.321	0.577	<b>0.847</b>	0.564	0.338	0.358			
IBPP1	0.670	0.564	0.604	<b>0.808</b>	0.590	0.262	<b>0.768</b>	<b>0.850</b>	<b>0.589</b>
IBPP2	0.304	0.339	0.376	<b>0.691</b>	0.142	0.387			
IBPP3	0.441	0.347	0.266	<b>0.664</b>	0.554	0.167			
IBPP5	0.545	0.614	0.637	<b>0.886</b>	0.308	0.653			
LGP1	0.293	0.312	0.175	0.243	<b>0.618</b>	0.107	<b>0.809</b>	<b>0.866</b>	<b>0.573</b>
LGP2	0.440	0.493	0.488	0.521	<b>0.897</b>	0.094			
LGP3	0.350	0.362	0.332	0.273	<b>0.657</b>	0.247			
LGP4	0.361	0.218	-0.001	0.289	<b>0.621</b>	0.045			
LGP5	0.417	0.484	0.451	0.548	<b>0.929</b>	0.090			
SQP1	0.328	0.468	0.353	0.411	0.174	<b>0.892</b>	<b>0.961</b>	<b>0.969</b>	<b>0.840</b>
SQP2	0.398	0.549	0.492	0.502	0.148	<b>0.972</b>			
SQP3	0.335	0.458	0.434	0.443	0.033	<b>0.914</b>			
SQP4	0.389	0.545	0.490	0.517	0.190	<b>0.903</b>			
SQP5	0.217	0.521	0.559	0.379	0.135	<b>0.843</b>			
SQP6	0.393	0.530	0.481	0.504	0.147	<b>0.969</b>			

TABLE IV: DISCRIMINANT VALIDITY USING FORNELL-LARCKER CRITERION

	CP	EOES	FP	IBPP	LGP	SQP
CP	<b>0.910</b>					
EOES	0.689	<b>0.843</b>				
FP	0.504	0.844	<b>0.819</b>			
IBPP	0.662	0.635	0.650	<b>0.767</b>		
LGP	0.491	0.517	0.435	0.521	<b>0.757</b>	
SQP	0.376	0.561	0.514	0.504	0.153	<b>0.916</b>

**Note:** Square roots of AVE shown on diagonal (in bold), while off-diagonals are inter-construct correlations.

### Structural model

In structural equation modelling (SEM), after the measurement model (outer model) has been examined and confirmed to be acceptable, structural model (inner model) assessment then followed based on the sign, magnitude and significance of the path coefficients of each hypothesized path. In order to determine the significance of each estimated path, the bootstrapping procedure was used with 5,000 resamples drawn with replacement. The quality of the structural model was also examined by its ability to predict endogenous construct using coefficient of determination  $R^2$ , its predictive relevance using Stone-Geisser  $Q^2$  and the fitness of the model using the standard root mean square residual (SRMR). The results for the structural model assessment are presented in table V and figure 2.

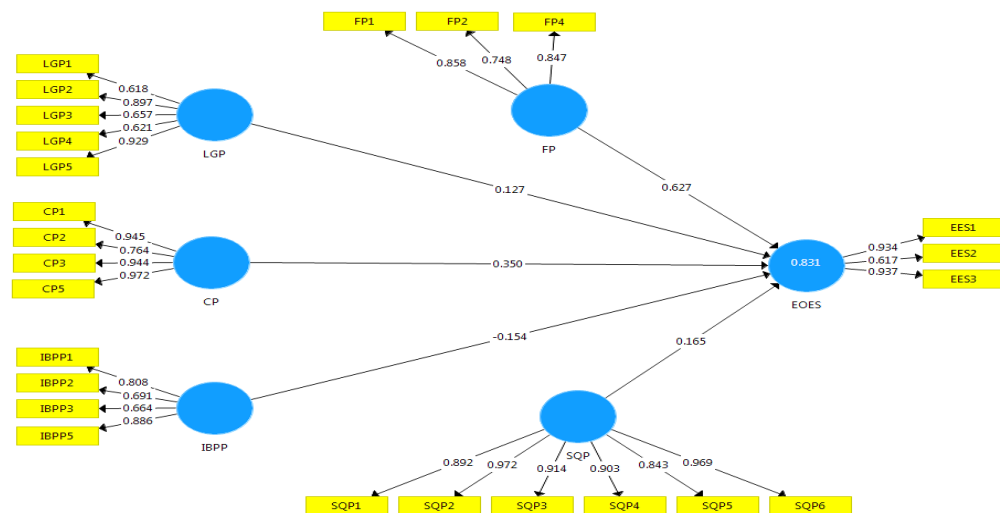
Financial perspective was found to have the most direct significant influence on effectiveness of ERP systems with parameters ( $\beta = 0.627$ ,  $p = 0.000$ ), thereby providing support for H1. Again, customer/stakeholder perspective was found to have a significant influence on effectiveness of ERP systems with parameters ( $\beta = 0.350$ ,  $p = 0.003$ ), providing support for H2. Contrary to expectation, internal business process perspective was found to have no significant influence on effectiveness of ERP systems ( $\beta = -0.154$ ,  $p = 0.083$ ), providing no support for H3. Learning and growth perspective was also found not to have a significant effect on effectiveness of ERP systems with parameters ( $\beta = 0.127$ ,  $p = 0.092$ ), thereby providing no support for H4. System quality perspective was found to have significant influence on effectiveness of ERP systems ( $\beta = 0.165$ ,  $p = 0.019$ ), 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 0.540, indicating predictive relevance. The SRMR value for the model was also found to be 0.071, which is far below the 0.08 threshold recommended by Hu and Bentler (1999). Therefore, the model presents a good model fit.

**TABLE V: PATH COEFFICIENTS AND THEIR SIGNIFICANCE**

Hypotheses	Path	Standard path coefficient ( $\beta$ )	T Statistic	P Value	Result
H1	FP→EOES	0.627***	6.999	0.000	Supported
H2	CP→EOES	0.350**	2.958	0.003	Supported
H3	IBPP→EOES	-0.154ns	1.732	0.083	Not Supported
H4	LGP→EOES	0.127ns	1.685	0.092	Not Supported
H5	SQP→EOES	0.165*	2.351	0.019	Supported
Coefficient of determination R <sup>2</sup>					0.831
Stone-Geisser Q <sup>2</sup>					0.540
SRMR					0.071

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



**Figure 2: PLS results for structural model (University of Ghana)**

## VII. 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.

### A. Case Study: University of Ghana

The ITS software system, is the ERP system used by the University of Ghana. This system integrates the finance, human resource, students and space modules of the university. The interview with the university authorities 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**

Manager interviewed stated that:

*ITS system is able to generate and deliver all data and information needed by government system such as controller and accountant general's department system for onward decision-making (Manager).*

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 has not been able to satisfy all our needs (Manager).*

Administrator interviewed asserted that:

*ITS system has really helped us to complete certain job activities and processes both within and outside the four wall of the university. This is because the system is a web-based system which allows you to work remotely (Administrator).*

**Learning and growth perspective of ERP systems effectiveness**

Manager interviewed stated that:

*There are documentations to the ITS system that helps users of the system to learn and to use the system. It also has a support unit which assists us when we encounter problems with the use of the system. Quick responses are received when we contact them for support (Manager)*

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).*

**VIII. DISCUSSIONS AND IMPLICATIONS**

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 effectiveness 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.

From the quantitative analysis, three (3) of the hypothesized paths were supported and two (2) were rejected. These results were in consistent with our qualitative analysis results and also with the work done by Parsa and Duffchali (2015)



and Peters and Aggrey (2019b). The implications of these results suggest that ERP systems effectiveness in the University of Ghana is greatly influenced by financial, customer/stakeholder and system quality perspectives. For that matter, the university must continue doing its best to maintain and improve these perspectives of the system. Again, these results also imply that the university is not achieving effectiveness of ERP systems in the internal business processes; and learning and growth perspectives. This is in partial support of the work done by Parsa and Duffchali (2015), who stated that internal business process perspective has the greatest impact while learning and growth perspective has the least impact. In summary, the ERP system (ITS system) of the university has been successfully evaluated and has proved effective with our research model.

## **IX. 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. First, 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. Second, there are other evaluation models or frameworks that can be integrated to study ERP systems effectiveness in HEIs. Third, 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 investigating ERP systems effectiveness in HEIs by comparing results from developed nation to developing nation which is the next area of research to be published soon.

### **Appendix**

#### **Financial Perspective (FP) and Indicators: Adapted from Kaplan (2010) and Brown (2012)**

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

#### **Customer/Stakeholder Perspective (CP) and Indicators: Adapted from Kaplan (2010) and Brown (2012)**

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

#### **Internal Business Process Perspective (IBPP) and Indicators: Adapted from Kaplan (2010) and Brown (2012)**

1. The ITS system has assisted us to create new innovative programs and activities
2. The ITS system has improved processes and activities leading to the delivery of information
3. Students support network has been strengthened with the ITS systems
4. With the ITS system, multiple tasks can be handled and to generate different formats of report
5. ITS systems help in the internal communications among various units or departments

#### **Learning and Growth Perspective (LGP) and Indicators: Adapted from Kaplan (2010) and Brown (2012)**

1. With the ITS system use in the university, various qualified faculty and staff members have been retained
2. The ITS system supports faculty professional practice and research

3. The ITS system comes with easy documentations and supports
4. The ITS system has helped me to learn excel, access and other software applications to develop my skills
5. ITS system has assisted to improve and manage information technology (IT) infrastructure

#### **System Quality Perspective (SQP) and Indicators: Adapted from Kaplan (2010) and Brown (2012)**

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

#### **Effectiveness of ERP System (EOES) and Indicators: Adapted from Parsa and Duffchahi (2015)**

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

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