

ORGANIZATIONAL FACTORS THAT INFLUENCE THE ADOPTION OF INTER-ORGANIZATIONAL INFORMATION SYSTEMS BY UNIVERSITIES IN KENYA

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ABSTRACT

IOS refer to the computer and telecommunications infrastructure developed, operated and/or used by two or more firms for the purpose of exchanging information that support a business application or process. Kenya government, in collaboration with other stakeholders involved in enhancing teaching and research in the learning institutions have constructed a terrestrial fiber-optic network that connects most institutions of higher learning to enable them integrate their facilities for the purpose of sharing resources. Despite these efforts, adoption of Inter-Organization Information Systems (IOIS) by universities in Kenya is far from being realized. This begs the question as to what organizational factors determines IOIS adoption in the universities. This study filled this gap by analyzing organizational factors of IOIS adopting in the universities in Kenya, given the mixed results from empirical evidence on IOIS adoption generally. A broad understanding of these factors is important to the policy makers who can embrace the motivating factors to enhance the adoption of the IOIS and suppress the barriers of its adoption. A cross-sectional descriptive survey was carried out using both qualitative and quantitative methods and a census done on 68 universities in Kenya. Data were collected using both questionnaires and semi-structured interview guide. University managers provided the required data. A logit regression procedure was used to analyze the collected data. The study revealed that the IOIS adoption is low adoption in the universities in

Kenya, which was attributed to various organizational factors. Organizational factors that were found to influencing IOIS adoption were top management support, number of personnel with IOIS skills and number of satellite campuses. The study recommended that: top management in the universities in Kenya should be educated benefits of IOIS in the universities, skilled personnel on IOIS technology should be engaged by the universities in Kenya and the universities that have satellite campuses should inter-link them using IOIS in order to enhance IOIS adoption in the universities in Kenya.

KEYWORDS: Inter-organization information system, IOIS adoption, IOIS factors determining adoption.

INTRODUCTION

IOS refer to the computer and telecommunications infrastructure developed, operated and/or used by two or more firms for the purpose of exchanging information that support a business application or process (Alimazighi and Bouchbout, 2009). The term Inter-organizational Information System (IOIS) was first used by Barret and Konsynski (1982), who coined the “IS” acronym for Inter-organization Information Sharing System — systems that involve information. resources like hardware, software, transmission facilities, rules and procedures, data/databases and expertise, which are shared between two or more organizations. Bakos (1991) conceptualized IOIS as an information system that facilitates the exchange of products, services and information between organizations, and include such technologies as electronic data interchange (EDI), Web-based EDI and Internet-based supply chain management systems, among others.

Areas where IOIS has been implemented

Some of the areas where IOISs have been implemented are in China’s retail enterprises to interlink retailers and the wholesalers and China’s supply chain management system to interlink various systems. This has made the growth of China’s economy to be attributed to the ability of her industries to operate more efficiently and effectively due to the adoption of IOIS (Chen-Yu, Huang and Zang, 2009).

The IOISs has also been used to link pharmaceutical wholesalers and pharmacies in the Republic of Ireland and Australia, respectively, to create efficiency in ordering and delivery processes between the wholesalers and pharmacies (Bekking, 2004). In Kenya, IOIS is found in the banking industry, where the IOIS allows internet banking to take place (Gikandi and Bloor, 2012), mobile banking service (Nyangosi and Arora, 2009) and in electronic commerce (Magutu *et al.*, 2011). By electronically linking organizations together, IOIS enables them to exchange business information, which makes them gain competitive advantage by increasing their bargaining power, and by raising the switching costs of trading partners (Johnston and Vitale, 1988). From a customer’s perspective, the IOIS enables organizations to be more responsive to customer’s orders, which improves the relationship with its business partners. From a broad view, the IOIS benefits are categorized into operational, managerial and strategic benefits (Rahim and Kurnia, 2004).

Benefits of IOIS

Electronically linking universities together or with other organizations through the IOIS enables the universities to share electronic services such as e-learning, e-library, e-research and other electronic services (e-services). In the twenty first century education system that is ever changing with

changes in technologies used to deliver the teaching materials, the need for IOIS adoption in the universities in Kenya is exacerbated by the fact that university students are now increasingly demanding for advanced methods of information acquisition, manipulation and application, and they show active preference for universities with greater access to Information System (IS) based resources (Adogbji and Akporhonor, 2005). Hence, universities that adopt the IOIS gain competitive advantages over the non-adopters.

Inter-Organization Information System Adoption by Universities in Kenya

Universities worldwide have increased their holdings of electronic information and integration of information technology in their operations, but within Africa, digital development has been uneven (Rosenberg, 2005). This has called for the environment of universities in Africa to change due to renewed recognition of the role that universities play as drivers of national development, making it necessary for investment in the electronic infrastructure and connectivity, as well as giving a higher attention to integration of e-learning, digital libraries (e-library), e-health and other related e-technologies in the universities that are key tools in enhancing the quality of higher education and making it more accessible (Rosenberg, 2005). Integrating these systems result to a cheaper, efficient and effective process of communication and information sharing.

Past studies have postulated that the future of universities greatly hinges on their ability to embrace and leverage the potentials of these emerging technologies at all levels of their business activities and strategies, including learning, teaching, research and administration (Venkatesh and Morris, 2000). In an effort to give the universities in Kenya a new face, Kenya Educational Network (KENET) constructed a terrestrial fiber-optic network that connects most institutions of higher learning, allowing institutions of higher learning to integrate their facilities for the purpose of sharing resources (KENET, 2009).

However, Kenya continues to drop in rankings in international Networked Readiness Index (NRI) despite the efforts made by KENET in leveraging the network interconnection in the universities, as stipulated in Table 1.1.

Table 1.1: International Networked readiness index

Period	USA	Kenya	South Africa	Mauritius
2004-05 (102 countries) Source: Dutta, Soumitra and Jain, Amit (2005)	4	75	34	47
2005-06 (115 countries) Source: Dutta, Soumitra and Jain, Amit (2006)	1	91	37	45
2011-2012 (142 countries) Source: Dutta and Osorio (2012)	8	93	72	53

Source: World Economic Forum / INSEAD Global IT Reports 2004-2012

Table 1.1 shows the NRI for Kenya in comparison to South Africa, Mauritius and the United States. The NRI measures not only the regulatory and national infrastructure, but also most importantly, usage by government institutions (such as universities), businesses and individuals. From Table 1.1, a low ranking for Kenya suggests low level of readiness and usage by businesses, government and individuals.

Motivation of the Study

Several studies conducted in the past to establish factors influencing the adoption of IOIS have focused on developed countries, with limited studies being done for developing countries. The findings of these studies do not have a common agreement on factors influencing IOIS adoption in organizations (Almazighi, 2009). Little research has been done to establish determinants of IOIS adoption in the in Kenya (for example, Gikandi and Bloor, 2010; Macharia and Nyakwende, 2010; Magutu *et al.*, 2011).

In the institutions of higher learning, the use of internet based systems such as the IOIS are still in their early stages in developing countries like Kenya, and many issues regarding their adoption have not been fully addressed (Macharia and Nyakwende, 2010). Kashorda, Waema, Omosa and Kyalo (2006) found out that higher education institutions were not yet ready to effectively use Information and Communication Technology (which is the underlying infrastructure of the IOIS) in teaching, research and management of these institutions, and the factors that influence these institutions to embrace the ICT and its related innovations are not yet established.

Research Hypothesis

This study collected and analyzed data to test the following research hypotheses:

HQ_1 : Top management support in a university had no influence on IOIS adoption by universities in Kenya.

HO_2 : Number satellite campuses that a university had had no influence on IOIS adoption by universities in Kenya.

HO_3 : Skilled personnel in IOIS technology that a university had had no influence on IOIS adoption by universities in Kenya.

HQ_4 : Number of collaborating universities and organizations that a university had had no influence on IOIS adoption by universities in Kenya.

HO_5 : Culture change development in a university had no influence on IOIS adoption by universities in Kenya.

Conceptual framework for the study

Organizational factors collectively influence the adoption of IOIS. The core organizational variables predicting IOIS adoption are borrowed from Alimazighi and Bouchbout (2009).

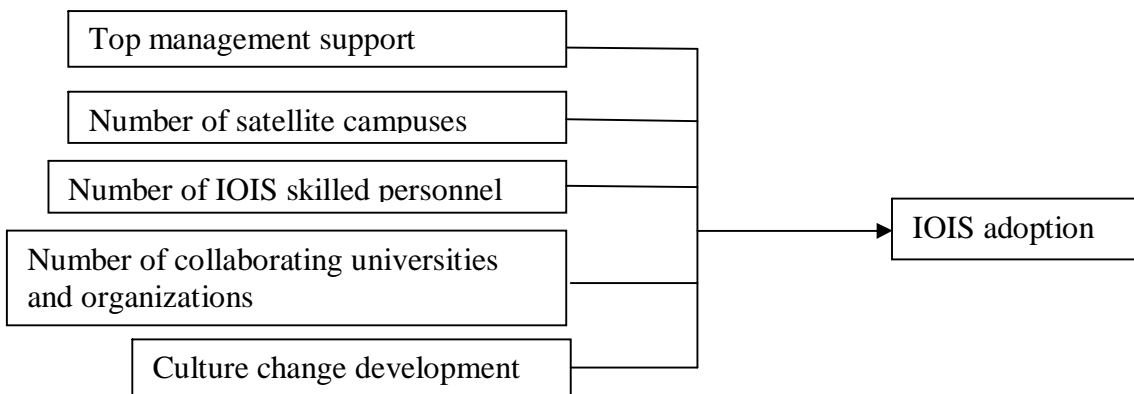


Figure 1: Conceptual Framework showing relationship between Independent and dependent variables.

Source: Adopted from Alimazighi and Bouchbout (2009).and modified by the researchers (2013)

Methodology

The study used a combination of cross-sectional descriptive survey and explanatory research design. Both quantitative and qualitative data was collected in order to gain a richer understanding of the factors influencing adoption of IOIS. Combining these methods together introduced both testability and context into the research, and increased the robustness of results because the findings were strengthened through cross-validation, leading to a richer understanding of the phenomena under investigation.

Theoretical Framework of the Model

The factors influencing the adoption of IOIS in this study were determined using the logistic model, also known as logit model. The model calls for the analysis and prediction of a dichotomous outcome. Traditionally, this could have been addressed by either ordinary least squares (OLS) regression or linear discriminant function analysis. However, both techniques were found to pose challenges in handling dichotomous outcome due to their strict statistical assumptions such as linearity, normality and continuity for OLS regression, and multivariate normality with equal variances and covariances for discriminant analysis (Cabrera, 1994; Lei and Koehly, 2000).

The choice of which technology to adopt in an organization, for example, is statistically related to the organization's capability to adopt it as well as the attributes of the technology itself. The models estimate the probability that an organization will adopt a particular technology (Karki and Bauer, 2004).

3.3.1 Empirical Model

The variables of the empirical model are identified from the reviewed literature as follows:

$$\ln \frac{P_i}{1-P_i} = Z = X\beta + \mu = \beta_0 + \beta_{i1} X_{i1} + \beta_{i2} + \dots \beta_{ik} + \mu \dots \dots \dots 3.1$$

$$\ln \frac{P}{1-P} = \beta_0 + \beta_1 Tmgt_i + Cmps_i + \beta_3 Skil_i + \beta_4 Colb_i + \beta_5 Ccde_i + \mu \dots \dots \dots 3.2$$

where:

P is the probability of adopting IOIS technology.

$\beta_1 - \beta_5$ are the coefficients from the log of the odds ratio function.

μ = a vector of random terms

Explanatory variables are:

$Tmgt$ is the top management support

$Cmps$ is the number of campuses

$Skil$ is the number of skilled personnel

$Colb$ is the number of collaborating universities

$Ccde$ is the culture change development in order to support IOIS adoption

Definition and Measurement of Variables

The independent variables stipulated in the empirical model are categorized into organization factors, inter-organization factors, technological factors, environmental factors, perceived benefits factors and perceived cost factors. They are operationalized and hypothesized to influence IOIS adoption positively, negatively or indefinite as depicted in Table 3.1.

Table 1: Operationalization and Measurement of Variables and Hypothesis

Category	Variable Definition	Operationalization	Measure	Hypothesized Direction of the Variable
Dependent variable	IOIS adoption (<i>Y</i>)	Three or more electronic link between a university's organizations' information system and other universities' or organizations' information systems is adopted, otherwise not adopted	Dummy variable based on the actual data: 1 if adopted, otherwise 0: if not adopted	None
Independent Variables				
Organization al factors	Top management support (<i>Tmgt</i>)	Support garnered from the top management of the university in allocating the necessary resources, supporting new processes and persuading other universities to join the IOIS cluster	Perceived influences on the IOIS adoption by amount of the support garnered from the top management of the university in allocating the necessary resources, supporting new processes and persuading other universities to join the IOIS cluster on a 1-5 scale	Positive
	Number of satellite campuses (<i>Cmps</i>)	Number of satellite campuses that a university has.	A continuous variable of the number of satellite campuses that a university has, which were perceived to influence the IOIS adoption in a university.	Positive

	Number of skilled personnel (Skil)	Number of personnel with IOIS knowledge and experience that a university has.	A continuous variable of the number of skilled personnel that a university has, which were perceived to influence the university to adopt the IOIS	Positive
	Number of collaborating universities (Colb)	Number of collaborating universities/organizations that a university has.	A continuous variable of the number of collaborating universities/organizations that a university has, which were perceived to influence the university to adopt the IOIS	Positive
	Culture change development (Cede)	Efforts made by the university to open the university data to be accessed directly by other university and organizations within the IOIS integration cluster.	Perceived influences on the IOIS adoption by efforts made by the university to open the university data to be accessed directly by other university and organizations within the IOIS integration cluster on a 1-5 scale	Positive

The Profile of the Study

The study was conducted on universities in Kenya that are established under the Kenya Government universities' Act of Parliament 5 of 1985 (Republic of Kenya, 2010), and accredited by the Commission of University Education in Kenya. This included: public universities; constituent colleges of public universities that were established in 2007 by a Legal Order under the Act of the universities; chartered private universities that have been fully accredited by Commission for University Education in Kenya; constituent colleges of private universities; universities with Letters of Interim Authority from the Commission for University Education in Kenya to offer degree level of education while receiving guidance and direction from the Commission for University Education in order to prepare them for the award of Charter; and registered private universities that were

offering university level education before the establishment of the Commission for University Education in 1985 and were issued with Certificates of Registration in 1989 by the Commission for University Education in Kenya.

Target population

A census was done on the universities in Kenya. Since there were only 67 universities in Kenya, this number was too small to sample since the logit model estimation requires a minimum sample size of about 50 samples according to Agresti (2007).

Data Collection Instruments

The study made use of both the primary and secondary data. The secondary data was collected by conducting a detailed review of various literatures such as strategic plan, research and training plans and reports of the various universities. This was expected to reveal factors that influence IOIS adoption in these institutions. Primary data was collected by use of semi-structured questionnaire as used by Ssewanyana and Busler (2007). The use of semi-structured questionnaire was deemed necessary to enable the researcher to collect both qualitative and quantitative data. Semi-structured questionnaire and interviews were administered to the ICT managers of each university.

A questionnaire was developed based on the objectives of the study. The questions were designed to cover general background information of the respondents relating to IOIS adoption based on the conceptual framework.

Data Analysis and Reporting

The first step involved coding the responses in the coding sheets by transcribing the data from questionnaire by assigning characters symbols (numerical symbols). This was followed by screening and cleaning of data to make sure there were no errors. Afterwards, data was analyzed based on the objectives of this study. The quantitative data was analyzed using descriptive statistics such as frequency distributions, mean and percentages. Open-ended questions was analyzed by first identifying themes or topics such as ideas, concepts, terminologies, behaviors or phrases used, then organize these themes into coherent categories that summarize and bring meaning to the text as suggested by Ratcliff (2002).

The binomial logit model was used for empirical analysis, to draw inference about the population. The correlation matrix test was used to examine the levels of multicollinearity between the independent variables. The independent variables that were not highly correlated were included in the model, and those that were highly correlated were omitted from the model as done by Oketch, Wawire and Mburu (2010).

The likelihood ratio test, which is analogous to the F-test in linear regression models (Kanninen and Khawaja, 1997), with its associated Chi-square statistics, was used for testing the overall significance of relationships estimated using maximum likelihood in a logit. Agresti (1990) argued that the likelihood ratio statistic was viable, particularly if the sample size is small or the parameters are large, and noted that a good model was one that resulted in a high likelihood of the observed results.

Results Discussions

Response rate

Out of the 68 questionnaires that were distributed to the respondents in the universities in Kenya, 47 were filled and returned. 12 senior managers were also interviewed which represented a response rate of 69%. This response rate compares well with the response rate recommended by Mugenda and Mugenda (2003), who argue that a response rate of 50 percent is adequate, a response rate of 60 percent is good, and a response rate of 70 percent is very good. Therefore, the 69 percent response rate reported for this study formed an acceptable basis for drawing conclusions on the determinants of IOIS adoption by universities in Kenya.

Regression analysis

Regression results to facilitate realization of the general objective of this study are presented based on equation 3.2 expressed in this study. A binomial logit model was estimated. In the model, the adoption of Inter-Organization Information System (IOIS) was the dependent variable that took the value of one (1) if IOIS was adopted and zero (0) if IOIS was not adopted. The explanatory variables that were considered included top management support, culture change development, number of IOIS skilled personnel, number of satellite campuses, number of collaborating universities and culture change development. The result of the logit regression is presented in Table 1.

Table 2: IOIS Adoption Logistic Regression Results

Variable	Coefficient	Std. error	Z	P> Z	95% coefficient	Interval
Top mgmt Support	4.10995**	2.05622	2.00	0.046	0.07982	10.3804
Skills	0.20766**	0.9661	2.15	0.032	-0.01831	0.39701
Campus	0.24192**	0.10990	2.07	0.028	0.02652	0.45733
Collaboration	-1.31135	1.44011	-1.91	0.363	-4.13393	1.51122
Culture development	1.48076	2.42506	0.61	0.541	-3.27228	6.23380
Number of observations		47		LR Chi squared (11)		38.31
Probability > Chi		0.0001		Pseudo R²		0.6507
*** Significant at 1 per cent level of significance				** Significant at 5 per cent level of significance		
* Significant at 10 per cent level of significance						

From Table 2, Log Likelihood (LR) tests gave a value of 38.31 which was statistically significant at 1% level. This implies that the overall logit model that was estimated was statistically significant, that is, there was a significant relationship between the log of odds ratio and the explanatory variables. The Pseudo R squared of the regression was 0.65, which implied that the included variables explained only 65 per cent of the variations in the adoption of the IOIS among the universities studied. The remaining 35 per cent was explained by other explanatory variables not included in the model.

The coefficients of three explanatory variables, namely, top management support (0.046), number of IOIS skilled personnel (0.032) and number of satellite campuses (campus) and culture change development (0.028) had the expected positive signs that were statistically significant at 5 per cent

level of significance. These result findings reveal that the adoption of the IOIS technology in the universities in Kenya is influenced by these three organizational variables.

The coefficients of the number of collaborating universities and organizations (-1.91) did not have the expected positive sign, and also was not statistically significant at 5 per cent level of significance. The Culture change development (0.61) had the expected positive but was also not statistically significant at 5 per cent level of significance. These result findings reveal that these two variables do not influence the adoption of the IOIS technology in the universities in Kenya.

Conclusion and suggestions for further study

In this paper we present Organizational factors that influence IOIS adoption in the universities in Kenya. The factors that were found to motivate IOIS adoption were the top management support, number of satellite campuses that a university has and number of IOIS skilled personnel that a university has. Number of collaborating universities and organizations and the culture change development were found not to have any influence in IOIS adoption by the universities in Kenya. The study draws the following conclusions on these variables:

Top management support

Top management support in a university was found to motivate IOIS in the universities in Kenya due to the fact that when the top management supports IOIS adoption, they allocate the necessary resources needed for its adoption. The universities that the top management supports the IOIS adoption are more likely to adopt the IOIS than in the universities where the top management does not support the IOIS adoption. Therefore, the universities should ensure that their top management is aware of the benefits of the IOIS, so that they can support its adoption in the universities. This should be done by conducting awareness campaigns on IOIS benefits in the universities in Kenya, and also training the top management of the universities on benefits that can be realized as a result of the universities adopting the IOIS.

Number of satellite campuses

The number of satellite campuses that a university had was realized to positively influence IOIS adoption in the universities in Kenya because most of the universities that had satellite campuses had adopted the IOIS in order to improve information flow between the satellite campuses. The universities that have satellite campuses are more likely to adopt the IOIS than in the universities that did not have satellite campuses. The study recommends that the universities in Kenya that have satellite campuses should inter-link then by means of the IOIS.

Number of skilled personnel in IOIS

The number of personnel with IOIS knowledge and skills of installing, operating and troubleshooting the IOIS technology was found to motivate the universities to adopt the IOIS. This could be attributed to the fact that a university would find it difficult to adopt the IOIS technology, without the necessary skilled personnel to manage it. As such, the universities that have personnel with IOIS skills are more likely to adopt the IOIS than in the universities that did not have personnel with IOIS skills. Universities in Kenya should engage technical personnel with IOIS knowledge and skills in order to increase the level of IOIS adoption in these universities.

Number of collaborating universities and organizations

The number of universities and organizations that a university collaborates with was found not to influence the adoption of IOIS by the universities in Kenya. This could be attributed to the fact that universities in Kenya have function independently without establishing partnership with other universities. The universities in Kenya should establish collaborations with other universities and organizations so as to share resources, which in turn will call for inter-linking that will be achieved by means of IOIS adoption. This will consequently raise the level of IOIS adoption in the universities in Kenya.

Culture change development

For universities to join an IOIS cluster, the personnel in each university must develop a culture that allows personnel from other universities in the IOIS cluster to access data internal to their universities. Without culture change development, IOIS adoption would be hindered. However, culture change development was found not to be an important determinant of IOIS adoption in the universities in Kenya. The study recommends that the universities in Kenya should develop a culture that allows personnel from other universities in the IOIS cluster to access data internal to their universities.

The study further recommends that the universities wishing to adopt the IOIS can put emphases on the factors that were found to influence IOIS adoption in this study, and enhance them in their universities in order to encourage IOIS adoption in such universities. The limitation of this study is that it only studied the organization factors (internal factors) that influence IOIS adoption in the universities in Kenya. A further study would be necessary, which will study other OIS technological factors that are external to the universities.

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