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The Critical Technological Factors OF E-Government in Kenya

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Abstract: EGovernment and innovation can provide significant opportunities to transform public administration into an instrument of sustainable development. However, the rate of failure of eGovernment projects in the developing world, and specifically Africa, has raised questions on the critical factors contributing to their success or failure. The general lack of comprehensive information concerning eGovernment project performance status and the critical technological factors influencing it in Kenya also necessitated this study. To answer this question, this study aimed at assessing the critical technological factors of eGovernment projects performance in Kenya. The study targeted all the 18 eGovernment projects in place implemented through the Communications Authority (CA) of Kenya. The results are based on response from 217 respondents who consisted of 52 eGovernment project implementers and 165 eGovernment service consumers. The study found that of the technological predictors of eGovernment, only system integration, processes and usage of eGovernment system emerged to have positive significant relationships with project performance in Kenya. Other factors including information technology standards, security issue, privacy issue, cooperation or collaboration, eGovernment portal availability, eGovernment portal access, and various computer usages also had positive but insignificant relationships with eGovernment project performance and hence not critical in influencing to eGovernment project performance in Kenya.

Keywords: eGovernment, Projects, Critical, Technological, Factors, Performance

1. INTRODUCTION

1.1 Background of the Study

We According to the UN (2014), eGovernment is basically defined as the use of ICT and its application by the government for the provision of information and public services to the people. More broadly, it can be referred to as the use and application of information technologies in public administration to streamline and integrate workflows and processes, to effectively manage data and information, enhance public service delivery, as well as expand communication channels for engagement and empowerment of people. The opportunities offered by the digital development of recent years, whether through online services, big data, social media, mobile apps, or cloud computing, are expanding the way we look at eGovernment. While eGovernment still includes electronic interactions of three types—i.e. government-to-government (G2G); government-to-business (G2B); and government-to-consumer (G2C)—a more holistic and multi-stakeholder approach is taking shape.

Governments have paid more attention to eGovernment in the last two decades, with central focus on its adoption. While the current UN (2014) survey indicates that eGovernment has been adopted by all the 193 UN global member states examined for online service provision, majority remain at the low or intermediate levels of eGovernment development, termed emerging and enhanced stages in the United Nations four stage online service model (UN, 2014). In addition, the regional representation mirrors those of past surveys, with a majority of 64 per cent (16 countries) from Europe, 20 per cent (5 countries) from Asia, 8 per cent (2 countries) from Americas and 8 per cent (2 countries) from Oceania. None of the African countries belongs to the top 25 ranks. Progress in Africa remains relatively slow and uneven with limitations in ICT infrastructure and human capacity posing the greatest challenge (UN, 2014).Therefore, hidden behind the massive adoption is the shocking fact that most eGovernment projects, especially in the African and developing countries have ended up failing (Heeks and Bailur, 2007). EGovernment is a multifaceted concept presented in three perspectives: technological, organisational and environmental perspectives (Oliveira and Martins, 2011).

Empirical studies have concluded that eGovernments in the developing African countries face numerous technological difficulties and hence the need for more home-grown studies to bridge the existing knowledge gaps (Ahmad, et al, 2012). Therefore, from a technological perspective, eGovernment refers to the use of information and communication technologies (ICT) -such as Wide Area Networks, the Internet, and mobile computing -by government agencies in provision of services (Cordella & Bonina, 2012). Based on this conceptualisation, eGovernment project's success or failure mainly depends on its ICT characteristics.

Technology is a prerequisite for e-government roll out and yet its adoption remains a major challenge for developed as well as developing countries. When developing an eGovernment system, ICT infrastructure in form of computers and other telecommunication hardware and software plays a bedrock role (Barker, 2011). Benefits such as efficiency, electronic service delivery and cost-effective services in the public sector due to adoption of eGovernment, cannot be fully achieved if there is a technical barrier.

Therefore, addressing technical barrier need to incorporate several elements, from hardware to software; in addition to other components, such as the Internet, web-technologies, telecommunication, networks connectivity and capacity,

databases, hardware equipment, software applications, design and interoperability (Basu,2004). ICT that shapes e-government also requires a properly aligned ICT strategy, satisfying system attributes, information/data management, and regulatory framework (Baker, 2011). It is in line with this background that this study sought to assess the technological determinants of eGovernment.

1.2 Statement of the Problem

In Kenya, just like in other developing nations, a myriad of technological challenges have been identified as influencing the successful implementation, adoption and use of eGovernment. Kenya is currently ranked number 119 globally, retaining same reanking since 2012 survey. However, in African countries ranking, it declined from number 7 (UN, 2012) to number 9 (UN, 2014). This saw Kenya ranked second in the East African Community after Rwanda in terms of their E-Government Development Index (UN, 2014). Despite their dismal in eGovernance, African governments support eGovernment and appreciate its contribution to the government agenda (Mutula, 2008).

The realization that for eGovernment projects in developing and transitional countries, 35% were total failures, 50% were partial failures and only 15% were successful (Heeks, 2003;Schedler and Schmidt, 2004), has drawn focus to unravelling the factors affecting success of eGovernment projects in the developing world. This study sought to answer this question by assessing the technological critical factors influencing performance of eGovernment projects in Kenya.

1.3 Objectives of the Study

1. To determine the technological factors influencing performance of eGovernment in Kenya.

2. To assess the nature of relationships between the technological factors and eGovernment performance.

2. LITERATURE REVIEW

Generally, many researchers have confirmed a positive relationship between the quantity and quality of ICT infrastructure and eGovernment Adoption, use, and hence successful eGovernment performance (Klischewski and Scholl, 2008). The perceived ICT availability, usefulness, compatibility, relative advantage, image, and complexity among other attributes can enhance or impede eGovernment project success (Ahmad, 2012). Specifically, there are many components and elements involved from hardware to software; in addition to other components, such as technology standards, eGovernment Portal and Access, security and privacy, ICT Strategy, infrastructure, Information/Data Management, and ICT Regulatory framework, design and interoperability (Al-Sobhi et al, 2010).

Ahmad et al. (2012), found that Technology standards can either impede or promote collaborative efforts between government agencies. They also found that the more complex and transformational eGovernment developments, the more integration is required among internal and external applications for success. The success of online services in eGovernment also depends on eGovernment Portal and Access that is in place for services rendered by the government (Schware and Deane, 2003). Heeks (2003), found that the more secure and privacy guaranteeing the systems are, the higher the confidentiality assurance and consequently the more the usage and successful eGovernment implementation outcome. The success of e-government is also directly related to the quality of ICT infrastructure, the telecommunication network infrastructure and their capacity, reliability and affordability (Basu, 2004). Lack of or poor ICT strategy, layout design and technical interoperability has been also found to influence eGovernment projects performance (Ahmad, 2012). Lack of technical skills, complexity, and difficulties in using eGovernment systems have been found to directly influence eGovernment performance (Gil-García and Pardo, 2005). Effort expectancy, which is defined as the degree of ease associated with the use of the system (Venkatesh et al., 2003) is the construct coined to accommodate all user difficulties. Three constructs make up the concept: perceived complexity, and ease of use. Schaper and Pervan (2007), found that effort expectancy has a significant influence on intention to use behavior and eGovernment success.

3. METHODOLOGY

3.1 Research Design

A cross-sectional descriptive research design was employed in this study. This is because descriptive research describes data and characteristics about the population or phenomenon being studied (Rohillo, 2010). It was therefore most appropriate for this study since the study aimed at analysing and describing the critical technological factors affecting eGovernment in Kenya. The study was however cross-sectional since data was collected at one particular time across all the existing eGovernment projects and both internal project environment (project implementers) and external environment (e-service consumers) respondents (Schurink, 2009).

3.2 Target Population

The study targeted all the 18 eGovernment projects that had been in place since 2005 and which were implemented through the Directorate of eGovernment (but now renamed CA) in Kenya government. The respondents therefore included all the eGovernment project implementers and eGovernment service consumers of the eGovernment services in Kenya.

3.3 Data Collection

The study collected both primary and secondary data. Primary data were collected using survey questionnaires supplemented with interviews and observations where necessary and possible. Secondary data sources included journals, books and articles addressing the objectives of this study.

3.4 Operationalization of Variables

This study employed quantitative measures using a 4-point likert scale and also qualitative measures as advocated by Agresti (2002). The operationalization and measurements of the variables in this study is as shown in Table 1 below.

Table 1. Operationalization and measurements of the variables

THE TECHNOLOGICAL FACTORS INFLUENCING EGOVERNMENT PROJECT IMPLEMENTATION, ADOPTION, & E-SERVICE USE IN KENYA		
Construct	**Construct Domains**	**Measures**
Technological Factors	ICT strategy	4-point likert
	ICT standards	
	National ICT infrastructure	
	ICT architecture interoperability	
	ICT security	
	ICT quality	
	ICT compatibility and interoperability	
	Linkages and communication among stakeholders	
	eGovernment system security and privacy	
	eGovernment system integration	
	eGovernment portal and access	
	eGovernment Project attributes.	

3.5 Data Analysis

Data analysis was performed at both descriptive and inferential statistical analysis levels using a mixture of tools available in SPSS. They include content analysis for the open ended questions; correlations and factors analysis through use of contingency tables; and logistic regression analysis. Descriptive statistics involved use of frequency tables, percentages and charts and other measures of variable associations (De Vaus, 2001). Inferential statistics included the Wald statistic, Odds Ratio, Pvalues, -2Log Likelihood size, and Nagelkerke R^2 values (Field, 2009; Saunders et al., 2003).

4. RESULTS AND DISCUSSIONS

The results are based on responses from the 217 respondents out of the 300 who participated (72% response rate). Of the 217 respondents, 52 were eGovernment project implementers while 165 were eGovernment service consumers.

4.1 The Technological Factors Influencing eGovernment Projects Implementation, Adoption and E-service Use (Success and Failure) in Kenya

Eight statements on four point likert scale were used to assess the technological factors affecting egovernment project implementation. The parameters that were measured include: Information Technology standards; Security issue; Privacy issue; System Integration; Cooperation or Collaboration; EGovernment portal availability; EGovernment portal access; and, Processes.The results are as shown in table 2 below.

Table 2.Technological Factors Descriptive Analysis Results

		Strongly disagree	Disagree	Agree	Strongly agree
Information Technology standards	All ICT assets are standard in terms of quality, compatibility and interoperability thereby enabling smooth linkages and communication among all eGovernment stakeholders	13%	40%	37%	10%
Security issue	There are enough computer security measures to secure personal data on the eGovernment systems.	6%	55%	29%	10%
Privacy issue	There is enough assurance of privacy and confidentiality on the eGovernment systems.	18%	40%	30%	12%
System integration	The eGovernment system is well integrated across different platforms to provide a full and real 'one stop shop' for dealing with the Kenya Government.	12%	43%	31%	14%
Cooperation or Collaboration	All stakeholders and government agencies are positively contributing to successful e-projects implementation	10%	27%	43%	20%
EGovernment portal availability	The Kenya government Portal is available and accessible all the time.	12%	43%	35%	10%
EGovernment portal access	Any Kenyan can use the government Portal to for payments any time.	23%	33%	37%	8%
Processes	EGovernment has caused positive changes to the entire process thereby significantly accelerating process execution (from a few minutes to a couple of seconds)	8%	18%	61%	14%

4.2 Test of Associations and Factor Analysis

The study sought to establish the specific factors predicting eGovernment projects performance from the collected data through tests of associations. This was achieved through correlations and factor analysis. The composite variables emerging from factors analysis were then used in regression analysis, presentation, interpretation and discussions of the outcomes.

The goal of factor analysis was to reduce "the dimensionality of the original space and to give an interpretation to the new space, spanned by a reduced number of factors (Darlington, 2004). Guttman-Kaiser rule was applied in retaining only the factors whose eigenvalues were larger than 1 and in total accounted for over 0.5 of the variance (Field 2000). Therefore, items with variance loadings of over 0.6 were retained for further analysis as recommended by Rietveld & Van Hout (1993).

Correlation Results

The results from correlations showed that most of the eight items including security issue, privacy issue, cooperation or collaboration, eGovernment portal availability,

eGovernment portal access,and processes correlated well with most of other items. However, information technology standards did not and hence was therefore eliminated and the rest used in running factor analysis.

Factor Analysis Results

The table 3 below shows the eigenvalues associated with each linear component (factor) before extraction and after extraction. In the end, the system retained all the items within one significant factor considered to significantly affect eGovernment implementation, adoption and use in the research. With only one factor extracted, there was no rotation conducted. The extracted components had Eigenvalue accounting for 57.480% of the variance explained. This figure being above the threshold of 50%, it indicates that the one-component factor model derived from the analysis fitted the data appropriately.

Table 3. Technological Factors Total Variance Explained Results

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.024	57.480	57.480	4.024	57.480	57.480
2	.997	14.238	71.718			
3	.625	8.928	80.646			
4	.463	6.621	87.267			
5	.411	5.871	93.138			
6	.261	3.731	96.869			
7	.219	3.131	100.000			

Extraction Method: Principal Component Analysis.

Items loading of over 0.6 for the component combined to form the one principal component with the variables clustering as shown in table 4 below. The cronbach alpha analysis for the new component reliability (0.875) also confirms internal consistency among all the derived technological factors therein. Therefore, the seven items are declared to belong to the technological dimension variable.

Table 4. Technological Factors Component Matrix Results

	Component
	1
Security issue	.818
Privacy issue	.810
System integration	.738
Cooperation or Collaboration	.760
EGovernment portal availability	.793
EGovernment portal access	.763
Processes	.605
Cronbach's Alpha	**.875**

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

4.3 Correlation Between Technological Factors and Project Performance

This was performed to determine the critical technological factors predicting eGovernment project performance in Kenya from the many proposed in the model. The table 5 below displays the correlations output. From the results, only system integration, processes and usage of eGovernemnt system emerged to have positive significant relationships with project performance hence declared critical at this stage and reserved for entry into the logistic regression model. However, Information Technology standards, Security issue, Privacy issue, Cooperation or Collaboration, eGovernment portal availability and eGovernment portal access, emerged to have also positive but insignificant relationships with project performance and hence dropped at this stage.These findings concur with those of Ahmad et al. (2012),who found that the more complex and transformational eGovernment develops, the more integration is required among internal and external applications for success. They also support Gil-García and Pardo, (2005) findings that lack of technical skills, complexity, and difficulties in using eGovernment systems (processes) directly influence eGovernment performance. They support the fact that transformation and re-engineering of government processes and activities must be embraced for successful eGovernment (Basu, 2004). However, the findings contradict that of Ahmad et al. (2012), who found that technology standards can either impede or promote collaborative efforts between government agencies and that lack of or poor ICT strategy, layout design and technical interoperability influence eGovernment projects performance. They also contradict Heeks (2003) finding that the more secure and privacy guaranteeing the systems are, the higher the confidentiality assurance and consequently the more the usage and successful eGovernment implementation outcome. These results are as shown in tables 5 and 6 below.

Table 5 Correlation BetweenTechnical Factors and Project Performance

		Information Technology standards	Security issue	Privacy issue	System integration	Cooperation or Collaboration	EGovernment portal availability	EGovernment portal access	Processes
Project performance	Pearson Correlation	.029	.230	.237	.398**	.245	.129	.284	.356*
	Sig. (2-tailed)	.847	.124	.118	.006	.101	.393	.053	.015
	N	47	46	45	46	46	46	47	46

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 6 Correlation Between ICT Usage and Project Performance

		Computer usage in performing business tasks	Computer usage in browsing, emailing, downloading and uploading information	Computer usage in buying things online, e-commerce and e-business	Computer usage in interacting with the government, downloading and uploading information government information	Usage of Kenya's eGovernment system
Project performance	Pearson Correlation	-.027	-.022	.047	.138	.189**
	Sig. (2-tailed)	.716	.760	.523	.058	.009
	N	188	194	185	188	191

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.4 Regression Analysis

In this study, regression analysis was necessary to assess the model Goodness of fit, R and R^2. Logistic regression was used and therefore interpretation of the results was based on the

Wald statistics, Odds Ratios, Pvalues, -2Log Likelihood sizes, and Nagelkerke R^2 values, which is generated in SPSS output (Field (2009). While the correlations outputs showed that there existed seven technological factors influencing eGovernment projects performance, regression analysis was necessary to go further in determining the critical ones among them that may need keen attention on the minimum to ensure success. Univariate logistic regression procedure was therefore performed to predict the probability that a participant would give his/her eGovernment project a success performance judgment (rating) given mere presence of or other behaviour attributes of the factor(s) considered.

Given the base rates of the two e-government project performance options (success=1 and failure=0), the system correctly grouped 62.2% of the respondents cases as having reported success of e-government project with only 37.8% of the cases reporting failure of e-government project based on the project performance characteristics alone. This finding contradicts the Heeks (2003) and Schedler and Schmidt (2004) study findings that eGovernment projects in developing and transitional countries are 35% total failures, 50% partial failures and only 15% were successful.

By testing the effect of each technological factor entered in the model, the results show that the 2 Log Likelihood function would drop by 6.589 if a single unit of the model technological factor (X_1) was added to the model (which already has the intercept) and the drop was highly significant (Pvalue = 0.010). Table 7 below shows the block1 outputs where the SPSS added Technological Factors (X_1) as the predictor. Omnibus Tests of Model Coefficients gave a Chi-Square of 7.076 on 1 df which was significant as the P-value (.008) was less than 5% (.05). This is a test of the null hypothesis that adding the independent variable to the model did not significantly increase the likelihood of the respondents to give an eGovernment project a success outcome judgment when it is correctly so. A positive and significant Chi-Square statistic indicates that there was a positive relationship between X_1 and the eGovernment project success performance.

Table 7 Omnibus Tests of the Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	7.076	1	.008
	Block	7.076	1	.008
	Model	7.076	1	.008

Under Model Summary printed in table 8 below, the -2 Log Likelihood statistics of 52.591, measures how poorly or well the model predicts the judgment decisions. The figure is small and smaller the statistic the better the model. The Cox & Snell R^2 can be interpreted like R^2 in a multiple regression although it does not reach a maximum value of 1. A value of .146 therefore implies that only 14.6% variation in the dependent variable is explained by the model. The study used the alternative, the Nagelkerke R^2 whose output of 0.198 indicates that a larger figure of 19.8% in the dependent variable is explained by the model.

Table 8 Model Goodness of Fit Tests Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	52.591[a]	.146	.198

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 9 below shows the Hosmer-Lemeshow statistic, which tests the null hypothesis that there is a linear relationship between the predictor variable and the log odds of the outcome variable. A chi-square statistic was then computed comparing the observed frequencies with those expected under the linear model. A non-significant chi-square indicates that there exists a linear relationship and therefore the data fits the model well (Pvalue = 0.808).

Table 9 Hosmer and LemeshowLinearity Test

Step	Chi-square	df	Sig.
1	3.003	6	.808

From Table 10 results, it is noted that overall success rate in classification has improves from 62.2%to 73.3% (11.1% contribution/prediction power) after adding the independent variable.

Table 10 Classification for the Final model

			Predicted		
			Project judgment		Percentage Correct
	Observed		Yes	No	
Step 1	Project judgment	Yes	22	6	78.6
		No	6	11	64.7
	Overall Percentage				73.3

a. The cut value is .500

Table 11 below shows the Regression Coefficients and Odds Ratio. The Wald Chi-Square statistic, which tests the unique contribution of each predictor, holding other predictors constant is also given. The output indicates that the predictor X_1 relationship with the outcome meets the conventional .05 standard for statistical significance. It's 2.565 odds ratio statistic indicates that the chances of eGovernment project success judgment are increased by more than double for each one point increase in respondent's exposure to or interaction with eGovernment project Technological Factors and the increase is highly significant (Pvalue =.016).

Table 11 Variables in the Model Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	X1	.942	.390	5.835	1	.016	2.565
	Constant	-3.458	1.305	7.024	1	.008	.032

a. Variable(s) entered on step 1: X1.

5. CONCLUSIONS

For the eight technological factors included in the models, seven of them (security issue, privacy issue, cooperation or collaboration, eGovernment portal availability, eGovernment portal access, and processes) emerged to fit well within the technological factors domain with Cronbach's Alpha above the 0.06 cut off. Only information technology standards stood on its own contradicting previous grouping of the factors within the technological factors domain.

In this study, only system integration, processes and usage of eGovernemnt system emerged to have positive significant relationships with project performance. Therefore, the three are the only critical technological factors predicting eGovernment projects performance in Kenya. The rest

including information technology standards,security issue,privacy issue, cooperation or collaboration, eGovernment portal availability, eGovernment portal access, and various computer usages emerged to have also positive but insignificant relationships with project performance and deemed less important in predicting eGovernment projects performance in Kenya.

6. RECOMMENDATIONS

Based on good practices from around the world, and the literatures reviewed in the study, effective e-government development depends on not only organizational and other environmental dimension factors, but also a robust ICT backbone. The UN(2014) survey also emphasise the need for proper national ICT policy and e-government strategy, backed by robust ICT infrastructure, adequate human capital and online service delivery, as of critical importance to the development of effective e-government for a sustainable and desirable future in the developing world.

Project implementers and e-service users in Kenya should therefore concentrate in managing the above highlighted critical technological factors because they determine eGovernment project implementation, adoption and use and hence eventual performance outcomes in Kenya. Researchers should conduct further studies in other settings and involving larger samples of eGovernment project stakeholders in order to explore all critical factors within the developing world contexts. This is very necessary because the current study only focussed on technological factors only. The critical environmental and organisational factors need to be highlighted too. These three dimensions have been noted to contain the factors behind the high failure rates of eGovernment projects in developing nations.

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