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An Enhanced Model for Adoption of Local Software: A Case of Kenya

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Abstract: The share of developing countries in the global software market has risen and now accounts for around 5 percent of sales. A small number of developing countries have successfully developed their own software industries and have continued to strengthen the sector even after 2000. However, many customers in Kenya frequently opt for better packaged and marketed software from India, United State or Unite Kingdom, even when these have to be overhauled to suit the Kenyan market. In doing so, the customers deny the local products the much needed breathe of life that is required to enable them to survive in the competitive software marketplace. Relatively little research has examined a model for the adoption of local software, either as a unique task or in the context of local software development in Kenya. This study attempted to explain how adoption of local software development is affected by the individual, technological, environmental and organizational determinants in Kenya. In this framework, explanatory research design was used. The population for this study was the 347 Information Technology and Information Communication Technology companies which provide software services in Kenya and their customers/users. The list was obtained from members of Kenya Information Communication Technology Providers Association. A sample of 35 managers from firms was taken and also 70 users. Purposive sampling was applied to select the product managers while random sampling was used to select the 70 customers. In this study, primary data was collected using a structured questionnaire. The researcher used Statistical Package for Social Sciences Version 20 (SPSS) to generate the descriptive statistics and inferential results. Confirmatory Factor Analysis was used to analyze the data and Structural Equation Modeling using Analysis of Moment Structures was used to validate the research model. Post study interview was carried out to test the applicability of the model. Data collected from interview was analyzed and presented using content analysis. The expected results include a model that can used to enhance adoption of local software. The study findings indicated that there was low level of local software adoption. Results further indicated that individual factors, technological factors, organizational factors and environmental factors were negatively correlated with adoption of local software adoption.

Keywords: *Adoption, Local Software, Model, individual factors, technological factors, environmental factors, organisational factors.*

1. BACKGROUND AND RESEARCH PROBLEM

Software is critical in today's markets. The importance of information and communication technologies, and thus the software that makes them function, is growing rapidly in both industrial and consumer markets. E-commerce, the Internet, enterprise-integration systems, and wireless networking are just some of the high-profile systems and applications dependent on effective software development. For software development, modern agile software development models address certain parts of this problem space (Boehm and Turner 2004). They are thus gaining more and more attention in many industrial product development organizations.

Local software production and development can spur economic growth in Africa and other developing economies, says report by UN Conference on Trade and Development 2013. Information Economy Report 2012 shows that ICT software and services are dominated by developed world. African countries, Kenya included must look onto ways of increasing the adoption and diffusion of innovation and to solve the problems they are experiencing.

Adoption rate of local software development in Kenya is very low. The biggest challenges facing software innovators in Kenya are the skill to package the software products, and the capital for marketing. Many Kenyans build softwares that never grow beyond a few customers. Many customers frequently opt for better packaged and marketed software from India, US or UK, even when these have to be overhauled to suit the Kenyan market. In doing so, the customers deny the local products the much needed breathe of life required to enable them survive in the competitive software marketplace (Kabugi, 2013).

The majority of studies relating to technology diffusion and adoption have been conducted in developed countries. Most of the studies focus on individual adoption behaviors and decisions. They do not necessarily lend themselves to studying organizational adoption of technology (King and Gribbins, 2002). Therefore, there is need for a research to come up with adoption model that suits the developing countries like Kenya and also a model that looks at the individual level of adoption and also the organization level.

In addressing the factors influencing software adoption in organizations there is the need for a model that specifically highlights these issues. Relatively little research has examined a model for the adoption of local software, either as a unique task or in the context of local software development in Kenya. This study attempts to explain how adoption of local software development is affected by the individual behaviours, technological, environmental and organizational determinants in Kenya.

2. RESEARCH OBJECTIVES

i. To establish the effect of individual, technological, organizational and environmental factors on the adoption of local software development.
ii. To formulate and evaluate the model for adoption of local software development.

3. METHODOLOGY

This research intended to empirically validate the proposed theoretical model (and hypotheses) of local software development in Kenya. Data from software developers includes those have not adopted local development at all, those that adopted and succeeded and those that attempted but failed were obtained touching on their perceptions, plans, success/fail factors, challenges, extents of adoption, actual gains etc. In this framework, explanatory research design was used. Studies that establish causal relationships between variables are termed as explanatory studies. The emphasis here is on studying a situation or a problem in order to explain the relationship between variables (Saunders, Lewis and Thorn, 2003). The target population for this study was the 347 IT and ICT companies which provide software services in Kenya and are listed as members of Kenya ICT Providers Association and also their users/customers. A sample of 10% which is 35 firms was taken. Two customers from each of the 35 firms were selected purposively. However, simple random sampling was used to select the 35 firms. In total the research had a sample of 105 (users and developers) to give the questionnaires. According to Gay, (2001) and Mugenda and Mugenda, (2003) a sample of 10-30% is deemed adequate for this study.

The data used for the purpose of the study was primary data collected by the researcher, through questionnaires and interviews. A questionnaire technique since it is suited for exploratory research. The researcher used frequencies, averages and percentages in this study. The researcher used Statistical Package for Social Sciences Version 20 (SPSS) to generate the descriptive statistics and also to generate inferential results. The individual hypotheses were tested using correlation analysis. Regression analysis was used to demonstrate the relationship between adoption of local software development and the determining factors. According to Mugenda and Mugenda (2003), the regression technique used to analyze the degree of relationship between two variables.

The multiple linear regression models adopted for the study was as follows:

$$Y=\alpha + \beta_1X_1+ \beta_2X_2+ \beta_3X_3+ \beta_4X_{4+}\varepsilon$$

Where: Y = Adoption of local software development

X_1 = Individual related constructs

X_2 = Technology related constructs

X_3 = Organizational related constructs

X_4 =Environmental related constructs

In the model α was the constant term while the coefficients β_1 to β_4 was used to measure the sensitivity of the dependent variable (Y) to unit change in the explanatory variables (X_1, X_2, $X_3$and X_4). ε is the error term which captures the unexplained variations in the model.

The first stage was testing /analysis of the model which was by running regression and correlations among the various variables. This was done after formulating the model, coming up with the correct questionnaire and then data collection.

The second stage was to identify which hypothesis was rejected and which ones were accepted.

According to Lule et al, (2012), to modify the model, ie to see which variables are the best at explaining the variance in adoption, factors analysis and structural equation modeling will be is used. Specifically, SPSS 20and AMOS module was used to perform Structural Equation Modeling (SEM). This is Structural Equation Modeling (SEM) software that uses Confirmatory Factor Analysis (CFA) to align the tested measures to the specific constructs and constraining the variances of each measure to the latent construct it should represent. In addition to assessing the degree to which each measure contributes to its latent construct, CFA also tests the separation between constructs by evaluating the fit in the overall model. There are four groups of fit measures and among the many measures of fit, four popular measures were use in this study. $\chi 2$ /df, GFI, TLI and RMSEA.

4. RESULTS AND FINDINGS

In order to establish the statistical significance of the independent variables on the dependent variable (adoption of local software) regression analysis was employed. Table 1 shows that the coefficient of determination also called the R square are 77%. This means that the combined effect of the predictor variables (individual factors, technological factors, organizational factors and environmental factors) explains 77% of the variations in adoption of local software. The correlation coefficient or R of 87.7% indicates that the combined effect of the predictor variables has a strong and positive correlation with adoption of local software. This also meant that a change in the drivers of adoption of local software has a strong and a positive effect on adoption of local software.

Table 1: Regression Model Fitness

Indicator	Coefficient
R	0.877
R Square	0.77
Std. Error of the Estimate	0.27412

Table 2 displays the regression coefficients of the independent variables. The results reveal that individual factors, environmental factors, technological factors and organizational factors are statistically significant in explaining adoption of local software. The findings imply that there is a significant relationship between environmental factors, organizational factors, technological factors, individual factors and adoption of local software.

Table 2: Regression Coefficients

Variable	Beta	Std. Error	t	Sig.
Constant	4.272	0.325	13.157	0.000
Individual Factors	0.471	0.122	3.865	0.001
Technological Factors	-0.059	0.008	-7.375	0.000
Organizational Factors	-0.062	0.011	-5.634	0.000
Environmental Factors	-1.038	0.216	-4.805	0.000

4.1 Combined Model Validation

A combination of constructs for both users and developers was used to generate the final model named TOIE model. The final result values from the developers and the users were added and then divided by two so as to come up with the values of the final model using SPSS software. In the case of the organizational factors the values for the factors were used as they were because it was only in the questionnaire of the developers.

The validation of the model was done by use of Analysis of Moment Structures (AMOS) module. AMOS is add-on module for SPSS. It is a program to assist with structural

equation modeling (SEM).AMOS is always used to help in modification and validation of model.
The Model Test shows that 42% of the variation in adoption is accounted for by the four factors (individual factors, technological factors, environmental factors and organizational factors). This percentage is very low. This requires that some modification should be done to get a percentage more than 50%. The above model shows poor fit as shown by the chi square of 32.274 and a p value of 0.000,degrees of freedom = 6. If the chi-square is significant, the model is regarded, at least sometimes, as unacceptable. The p value should not be significant. It should be more than 0.05 according to Hu and Bentler, 1995
According to James Bowers, Jr., MABen Jarrett in their study and which was adopted by researchers like Arbuckle (2007), Blunch (2008), if a model has a poor fit it can be modified by adding or removing connections, adding variable or dropping variables. To get a model with a good fit I therefore decided to modify the model by adding connections and have correlation between the independent variables.

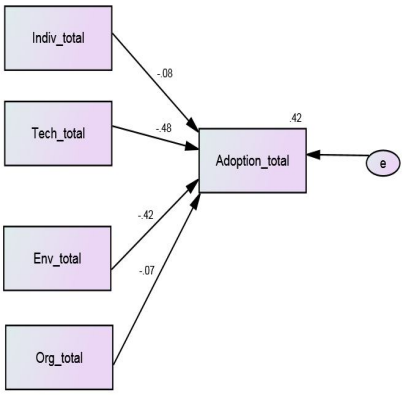

Figure 1: Result of the Model Test

4.2 Validated and Final Model (TOIE Model)

The squared multiple correlations are the proportion of variance that is accounted for by its predictors. The final model in figure 2 shows that 90% of the variation in adoption is accounted for by the four factors (individual factors, technological factors, environmental factors and organizational factors).
Table 2 shows that the model fitness is good. A good fit indicates that the model is fit. This is indicated by a CMIN Value of 14.260 and a p value of 0.65.

Table 2: CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	20	14.260	5	0.65	2.852
Saturated model	20	.000	0		
Independence model	5	90.269	15	.000	6.018

The research by Lule et al. (2012) had the standards to be used to show a good fit. The standard values for $\chi 2$ /df, GFI, TLI and RMSEA. The table below shows the standard values used and which were compared with the values which the validated model of TOIE produced.

It was important to look at the regression of the final validated model so as to get the significance values of the validated model and to check if the independent variables were affecting the dependent variable negatively or positively. Table 3 shows the significance and the beta values for both unstandardized and standardized model.

Table 3: Validated model Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.727	.300		5.759	.000
Individual factors	-.094	.043	-.110	-2.178	.034
Technological factors	-.178	.049	-.272	-3.638	.001
Environmental factors	-.127	.030	-.206	-4.222	.000
Organization factors	.755	.092	.644	8.177	.000

a. Dependent Variable: adoption of local software

The above table shows the regression coefficients of the combined and final model. All the independent variables were significant in predicting adoption of local software. Individual factors, technological factors, Environmental factors and organization factors had p-values of 0.034, 0.001, 0.000 and 0.000 respectively.
Increase in individual factor by one unit decreases adoption of local software by 0.110 while increase in the Technological factors by one unit will decreases adoption of local software by 0.272. On the other hand increase environmental factors by one unit decreases adoption of local software by 0.206. Finally increase in organization factor by one unit increases adoption by 0.644.
Order of importance among the four factors is as follows: Organization factors affect the adoption of local software the most. This is because when the organization develops a good culture towards local software development then they will develop good software with high quality and also when the organization is big and have enough resources they will be able to invest more in the process of software development. Quality things are always expensive. It is then followed by Technological factors; this is because when the software is compatible and is secure more people will use it. Environmental factors are the third factor to affect adoption of local software. Individual factors affect the adoption of local software development but at a low rate. This is because the PEOU and PU can easily change. If a user is told by someone that Oracle is the best software then they can easily believe them and stick to using that Oracle software.

4.3 Validated Model

The validated model in Figure 2 has 90 % coefficient of determination which is a very high percentage indicating that the model is very good. The model has a good Chi-square of 14.260 and p value of 0.65. The higher the probability level (p

value) associated with chi square, the better the fit. Amos reports the value of chi-squre as CMIN. Some of the construct exhibited stronger significance than others, this is through the –ve and +ve values on the figure. The –ve values will decrease the adoption of local software while the +ve values will increase the adoption of local software. The model is generic and can be used in any developing country. In the figure it is clear to view the correlation between the independent variables (covariance) and also the correlation between the independent and dependent variables (regression)

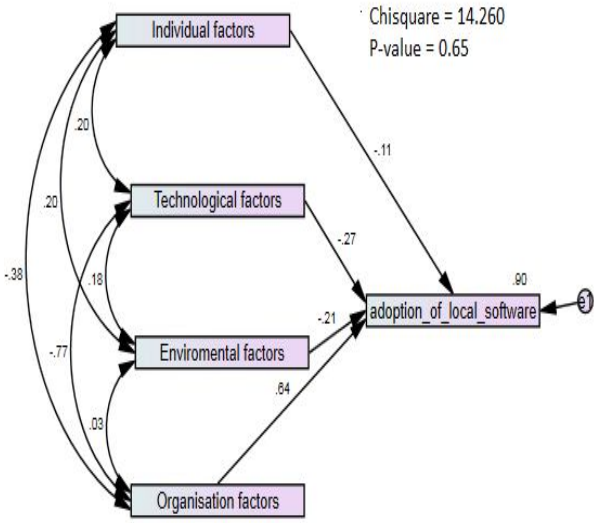

Figure 2: Validated Model

5. CONCLUSIONS AND RECOMMENDATIONS

Based on the objectives and the findings of the study from the users the following conclusion can be made: There was insignificant relationship between adoption of local software and perceived ease of use and regulatory environment. On the other hand there was significant relationship between adoption of local software and perceived usefulness, compatibility and security and privacy. The users need a software which is secure, compatible and useful to them. Developers should therefore consider these factors when developing softwares.

Based on the objectives and the findings of the study from the developers the following conclusion can be made: There was insignificant relationship between adoption of local software and perceived usefulness. There was a significant relationship between adoption of local software and developers` entrepreneurship capabilities, perceived ease of use, organization culture and organization size and resources, industry competition, regulatory environment. The developers of local software should consider these factors when developing.

It is therefore clear that even though some of the factors were not significant to the users, the same factors were important to the developers. This then required the combination of all the factors so as to come up with a final model. When the variables under the four main categories so as to come up with the main factors affecting adoption of local software development. It was therefore clear that perceived usefulness, developers` entrepreneurship capabilities, compatibility and security and privacy perceived ease of use, organization culture and organization size and resources, industry competition, regulatory environment affect the adoption of local software development. The above variables fall under Individual, Technological, organizational and environmental factors. The countries like India, USA, UK and other developing countries have put into consideration when developing and adopting their local softwares and this have made them have an edge over the developing countries.

There was correlation between the independent variables, this shows that they have a relationship to each other. Individual, Technological, organizational and environmental factors relate with each other and must be considered when developing the local software.

The final model is fit when the following four factors were combined, Individual, Technological, Organizational and Environmental factors. All the above factors were significant determinants of adoption of local software. Organization factors affect the adoption of local software the most. It is then followed by Technological factors. Environmental factors are the third factor to affect adoption of local software. Individual factors affect the adoption of local software development but at a low rate. All these factors must be considered when developing software.

The government should use these findings and be able to give tax incentives to the local software developers so that they can be able to invest more in the local software development. Also the government should be able to put strict laws concerning copyright and patents. This will enable the developers or the innovators of the technology to have the full rights on the innovation and be able to sell and meet the market demand.

The final model TOIE consists of the factors which are required in adoption of technology and softwares. It has the individual factors which is lacking in TOE and are very important and also have the Technological, environmental and organizational factors which is lacking in TAM model. It's therefore considered superior than the other earlier models

5.1 Recommendations

The developers must be able to have entrepreneurial knowledge and skills so as to be able to maintain the business and get advantage over the competitors. This is one of the reasons why India is one of the biggest producers of software.

There was a negative and significant relationship between adoption of local software and regulatory environment. It is therefore recommended to the government to give developers of local softwares incentives such as tax breaks and laws that place minimum requirements for development of local softwares and also the laws that will guard the copyright.

It is therefore recommended that when developing local software all the above factors must be considered. This will help to increase the adoption of our own softwares hence improve the economy.

The developers must be able to have entrepreneurial knowledge and skills so as to be able to maintain the business and get advantage over the competitors. This is one of the reasons why India is one of the biggest producers of software.

The model is generic and therefore can be implemented in other developing countries so as to boost the economy of the developing countries. Technology is the key to development.

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