The Influence of National Information Ecology on e-Commerce Adoption in Developing Countries[1]

Nixon Muganda Ochara[1[0000-0001-5736-7901]], Armstrong Kadyamatimba [2[0000-0002-9638-0858]], Paul Lehloa[1[0000-0001-8205-3840]], and Alexander Sotnikov[2[0000-0003-2985-3704]]

[1] University of Venda, Thohoyandou Limpopo, South Africa
[2] Joint Supercomputer Center of the Russian Academy of Sciences
[1]nixon.muganda@gmail.com; [2]asotnikov@jscc.ru

Abstract. The focus of this study was to identify the impact of government policy, legal environment, socio-cultural framework, Gross Domestic Product (GDP), Internet diffusion and technology transfer on the national adoption of e-Commerce in developing countries. A cross country analysis, using data sets that were based on a quantitative survey was used in this study. The study concluded that socio-cultural factors have the most influence on e-Commerce adoption. Technology transfer and Internet diffusion provided some level of mediation which improved the significance level of other variables. The results also demonstrate that the information and computer literacy problem can only be addressed by enhancing various organizing forms in order to improve e-Commerce diffusion. The mediating role of the organizing forms is critical in galvanizing local community participation, for instance in capturing and accumulating cultural knowledge as a basis of developing relevant content for enhancing community participation in e-Commerce. These findings can advance policy implementation, particularly in integrated development planning in developing countries that continue to suffer from a lack of adequate knowledge regarding the digital commerce environment. Further, as the Big Data & Analytics finds traction in the e-commerce environment, the trajectory of ecommerce adoption is likely to change dramatically in developing countries.

Keywords: e-Commerce Adoption, Technology Transfer, Legal Framework, Government Policy, Integrated Development Planning, Big Data

1 Introduction

1.1 Background of the Study

Multiple studies of e-Commerce (e-commerce) adoption show that adoption in developed countries is higher than in developing countries [1]; [2]. The main factors influencing adoption relate to cultural differences, national infrastructure, supportive government policies, education level, economic levels, legal environment and others. However, these prior studies have focused mostly on individual adoption rather than

[1] The study was funded by RFBR and NRF according to the research project № 19-57-60004

national adoption. It was found that national information ecology factors (e.g., government policy, legal framework and socio-economic infrastructure) together with the economic level of the country as measured by Gross Domestic Product (GDP) could play an important role in adoption of e-commerce [1]. Internet diffusion and Technology Transfer can be incorporated into the national information ecology framework to understand factors that could contribute to national adoption of e-commerce in developing countries. In this study, e-commerce is considered as an electronic means for conducting business over the Internet [3]. This study aims to answer the following research question: how does national information ecology influence adoption of e-commerce in a country? The objective of this study is to test and explain the influence of national information ecology factors on e-commerce adoption in selected countries in sub-Saharan Africa.

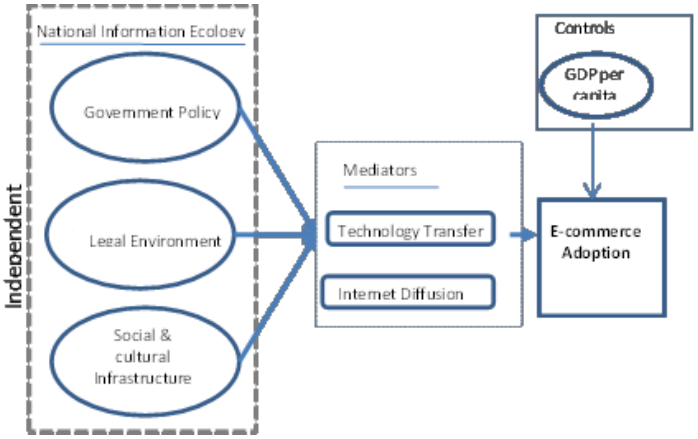
1.2 **Informing Literature and Model Development**

According to Kumar, Kumar, Dutta and Fantazy [4], Technology Transfer is an effective mechanism to advance the flow of technological development in a developing country's economy. Technology transfer helps the diffusion process of newer technologies from developed to developing countries. Strong government support, communication and education of adopters are the most crucial factors in transfer of technology [4]. Zhu and Thatcher [1] discuss national adoption using a multi-point approach and institutional theory, focusing on the external environment for e-commerce. National Information Ecology deals with policy, legal and socio-cultural environments. Previous studies have incorporated institutional theory of new institutional economics and ecosystems in the study of national information ecology in developing countries [1]; [5]). Rogerson and Rogerson [6] point out that conducive government policy is necessary for the private sector to operate; that it reduces the cost of doing business, unleashes economic potential and attracts investment. A study by Molla and Licker [7] also reveals strong links between government policy and e-commerce adoption. The readiness of government to promote e-commerce defines the institutional environment within which businesses operate and influences their confidence and level of e-commerce aspirations. Based on the analysis above, we propose national information ecology factors (e.g., government policy, legal environment, and socio-cultural infrastructure) as critical influencers of e-commerce adoption, mediated by Internet diffusion and Technology Transfer; while GDP acts as a control variable. We test this model, using data from SADC. The propositions emanating from the research model are highlighted in Figure 1.

Hypotheses:
.H11: Government policy influences adoption of e-commerce in a country
H10: Government policy does not influence adoption of e-commerce in a country
H21: Legal environment influences adoption of e-commerce in a country
H20: Legal environment does not influence adoption of e-commerce in a country
H31: Socio-cultural factors influence adoption of e-commerce in a country

H30: Socio-cultural factors do not influence adoption of e-commerce in a country
H41: Internet diffusion influences adoption of e-commerce in a country
H4: Internet diffusion does not influence adoption of e-commerce in a country
H51 Technology transfer influences adoption of e-commerce in a country
H50: Technology transfer does not influence adoption of e-commerce in a country

Fig. 1. - Research framework (adopted from Zhu and Thatcher, 2010)



2 Research Methodology

2.1 Research Design

A positivist quantitative survey approach relying on datasets was adopted in this study. The sources of secondary data are e-commerce and IT reports from Economist Intelligence Unit (EIU), World Bank, World Economic Forum (WEF) and United Nations Conference on Trade and Development (UNCTAD), Global Information Technology Report (GITR) that provide current and historical global data on ICT related developments and the Electoral Institute for Sustainable Democracy in Africa (EISA) and other miscellaneous sources. This study focused on the SADC region particularly because its member countries are all under the developing countries' category and most of them share common characteristics.

2.2 Measurement Items

The dependent variable (DV) is e-commerce adoption, while the socio-cultural framework, legal and policy environments are the Independent Variables (IV), and Internet Diffusion as well as Technology Transfer are mediating variables (MV) and GDP is the control variable. Data for DV is gathered from the GITR (2012), while all other variable are taken from the World Bank online database. The data is a mixture of ratios (e.g., Literacy Rate, Unemployment and Poverty Ratio) which are all part of the socio-cultural component as well as Internet Penetration. Government Policy and

Legal Environment values are also ratios and E-Commerce Adoption and Technology Transfer are rank values from a Likert scale of 1 to 7 with 1 being the lowest and 7 being highest as per the GITR description (2012, p171). The measurement items for the study are found in Table 1.

Table 1. Measurement Items

Measurement Items	Variables	Sources
Government Policy	1. Government Effectiveness 2. Political Stability 3. Rule of Law	World Governance Indicators (World Bank, 2012)
Legal Environment	1. Regulatory Quality	World Governance Indicators (World Bank, 2012)
Social and Cultural Infrastructure	1. Literacy Rate	World Bank (Bank Data, 2012)
	2. Unemployment Rate	EISA
	3. Poverty Rate	World Bank (Bank data, 2012)
E-Commerce Adoption	1. Business Usage 2. Individual Usage 3. Government Usage	Source (GITR, 2012)
Internet Diffusion	1. Internet Penetration 2. Internet Penetration	www.Internetworldstats.com Internet world statistics (2012)
Technology Transfer	1. Infrastructure and Digital Content	Source (GITR, 2012)
GDP		EISA

3 DATA ANALYSIS AND RESULTS

3.1 Overview

The overall objective of the analysis in this section is to explain the degree and nature of the relationship between E-Commerce Adoption (DV) and the independent and mediating variables relating to Government Policy, Legal Environment, Social and Cultural Infrastructure, Internet Diffusion, Technology Transfer and GDP.

3.2 Descriptive Analysis

According to the results presented in Table 2, two variables are missing a score. Multiple Regression uses only the 13 variables with complete data (e.g., Angola, Botswana, Lesotho, Malawi, Madagascar, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe). Data for Business Usage and Infrastructure plus Digital Content was missing for the Democratic Republic of Congo and Seychelles. Population had a high mean and the frequency graph shows that GDP is skewed to the left showing a large gap in GDP among the sample under review. Data from the World Bank (2010) in Millions of US Dollars shows that South Africa had a highest GDP at 276.8, Angola at 84.937, Tanzania at 22.915, Botswana at 14.838, DRC at 13.144, Zambia at 14.314, Mozambique at 9.735, Mauritius at 8.651, Namibia at 8.563, Malawi at 4.269, Swaziland at 2.618, Lesotho at 2.179, Seychelles at 0.835 and Zimbabwe at 0.641.

Table 2. Descriptive Statistics

	Mean	Std. Deviation	Skewness	N
Gross Domestic Product (GDP)	.0532839	1.06880407	3.402	13
Internet Penetration	-.1086203	.73356015	1.434	13
Literacy Rate	-.0090683	.98895867	-0.557	13
Unemployment	-.0581109	.92019580	1.473	13
Poverty Ratio	.0345676	.83252174	-0.373	13
Government Effectiveness	.0741100	.91323328	-0.166	13
Political Stability	.1174103	.74180768	-1.363	13
Rule of Law	.0796999	.95905771	-0.289	13
Regulatory Quality	.1240085	.98079701	-0.282	13
Individual Usage	.0000000	1.00000000	2.236	13
Business Usage	.0000000	1.00000000	0.677	13
Government Usage	.0000000	1.00000000	-0.556	13
Technology Transfer	.0000000	1.00000000	0.515	13

The skewness above 1.5(+ or -) are considered to abnormally distributed [8]. GDP exceeded 2.5 and hence was not normal in this case. The skewness of GDP was expected since the different countries are at different levels of economic development. GDP could not be excluded since other studies have shown that it plays a major role [1]. The standard error of skewness is indicative of normal distribution of data, which is less than 1.5 for all variables, except GDP and individual usage. Multiple Regression does not allow treatment of multiple DVs thus individual use and government use are dropped leaving Business Use as a proxy for E-Commerce Adoption because it has a smaller standard deviation. Rule of Law was also dropped leaving Regulatory Quality because it has the smaller standard deviation.

3.3 Inferential Analysis

This study followed a four-step analysis process. Step 1 involved a Multiple Regression Analysis (MANOVA) with all variables excluding mediating variables (i.e., Internet Diffusion, Technology Transfer) in order to test for a direct relationship with E-Commerce Adoption. Step 2 is using a MANOVA with all variables predicting the mediation caused by Internet Diffusion and Technology Transfer. Step 3 is using a MANOVA with Internet Diffusion, then Technology Transfer predicting E-Commerce Adoption. Step 4 is using a MANOVA with all variables including mediating variables predicting E-Commerce Adoption (Table 3).

3.4 Testing for Mediation with Regression Analysis.

The results indicate that in Step 1, all variables excluding the mediators significantly predict E-Commerce Adoption at a model fit of 91%. There is no significant relationship in Step 2 for both Technology Transfer and Internet Diffusion. However, there is a strong relationship between Technology Transfer and E-Commerce Adoption and

very little between Internet Diffusion and E-Commerce Adoption. The relationship between all variables including mediators is significant at a p-value < 0.1 with 72% explanation for the variance in E-Commerce Adoption. The observation is that some form of mediation is supported as shown by a significant value in Step 4.

Table 3. Test for Mediation

Step	IV	DV	Sig	Adjusted R^2 (%)
1	GDP, Unemployment, Government Effectiveness, Rule of Law, Regulatory Quality, Literacy Rate, Poverty Ratio, Government Usage, Individual Usage, Political Stability	E-Commerce Adoption	0.070	91%
2	GDP, Unemployment, Government Effectiveness, Rule of Law, Regulatory Quality, Literacy Rate, Poverty Ratio, Government Usage, Individual Usage, Political Stability	Technology Transfer	0.233	69%
		Internet Diffusion	0.722	36%
3	Technology Transfer	E-Com. Adoption	0.000	72%
	Internet Diffusion	E-Com. Adoption	0.181	8%
4	GDP, Unemployment, Government Effectiveness, Rule of Law, Regulatory Quality, Literacy Rate, Poverty Ratio, Government Usage, Individual Usage, Political Stability, Technology Transfer And Internet Diffusion	E-Commerce Adoption	0.126	72%

The rest of the analysis will continue based on the results in Step 4. GDP together with Internet Penetration violated the kurtosis rule. Mean and standard deviation satisfied the rules at the mean of 0 and standard deviation of 1 for all variables (Table 4). The assumptions for using a MANOVA include the following; that the relationship between each of the predictor variables and the DV is linear and that the error, or residual, is normally distributed and uncorrelated with the predictors [8]. The simultaneous multiple regressions using all the variables at the same time was used given that the number of predictors was small. After dropping the Individual Use and Government Use, leaving Business Use as a proxy for ICT Usage and hence E-Commerce Adoption plus dropping Rule of Law, leaving Regulatory Quality, the mean and standard deviation met the rules on 0 and 1 respectively (Table 4).

Table 4. Table of Residuals

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-1.3605034	2.1515248	.0000000	.98656873	13
Residual	-.27351445	.23217899	.00000000	.16334670	13
Std. Predicted Value	-1.379	2.181	.000	1.000	13
Std. Residual	-.684	.580	.000	.408	13

a. Dependent Variable: Business Usage

Linearity Using ANOVA Test.

Since multiple regression models assume linearity, the linear association between each IV and DV was tested using an ANOVA test of linearity (Table 5). The F statistic is 4.360 and significance value for the nonlinear components was above the critical value (i.e., $p < 0.1$). The results showed that all IVs do not have a linear relationship with the DV of Business Usage. The significance value of .126 indicates that these variables can be used to explain the DV given that the study is using secondary data, the population size is small and that there could be some other factors that could play a role in explaining E-Commerce Adoption but are not included in this model. Therefore, at the significance level of .126, the model can be accepted, meaning the predictors can marginally explain E-Commerce Adoption.

Table 5. ANOVA Table

Model		Sum of Squares	df	Mean Square	*F*	Sig.
1	**Regression**	11.148	9	1.239	4.360	.126[b]
	Residual	.852	3	.284		
	Total	12.000	12			

a. Dependent Variable: Business Usage

b. Predictors: Technology Transfer, Unemployment, GDP, Political Stability, Internet Penetration , Literacy Rate, Poverty Ratio, Government Effectiveness, Regulatory Quality

Given that:

Business Usage = function (GDP, Internet Penetration, Literacy Rate, Unemployment, Poverty Ratio, Government Effectiveness, Political Stability, Regulatory Quality)

Or

Business Usage = $\beta 1 + \beta 2 \times$ GDP $+ \beta 3 \times$ Internet Penetration$+ \beta 4 \times$ Literacy Rate $+ \beta 5 \times$ Unemployment $+ \beta 6 \times$ Poverty Ratio $+ \beta 7 \times$ Government Effectiveness $+ \beta 8 \times$ Political Stability $+ \beta 9 \times$ Regulatory Quality $+ \beta 10 \times + c$.

Assuming that F is testing the hypothesis that $\beta 1 = \beta 2 = \beta 3 = \beta 4 = \beta 5 = \beta 6 = \beta 7 = \beta 8 = \beta 9 = \beta 10$, since F is significant, the use of the IV has assisted us in explaining the DV (Business Usage). Total Sum of Squares (TSS) is 12.000. This shows the deviations in the DV. Regression shows the Explained Sum of Squares (ESS) of 11.148, which is the amount of TSS that could be explained by the model. The Residual Sum of Squares (RSS) is 0.852, which is the amount that could not be explained by the model. RSS represents unexplained variation and a smaller RSS means that the model fits the data well.

Correlation Analysis

The results for correlation analysis (Table 6) show that Literacy Rate (LR) is highly correlated with Technology Transfer (TT) with a coefficient of 0.701 at a significance level of .008; which means as people get more educated; they are likely to adopt new technologies. Poverty Ratio (PR) is highly correlated with Government Effectiveness (GE) with -0.793 at a significance level of .001, and Political Stability (PS) with -

0.576 at a significance level of .039. Poverty is also highly correlated with Regulatory Quality (RQ) with -0.709 at a significance level of .007. These results show that poverty is more prevalent in countries affected by corruption and lack of proper governance. There will be less poverty in a more stable government since there will likely be fewer wars, political strife and other factors that consume resources that could otherwise be channeled to poverty eradication. Rule of Law can be the foundation for proper governance, which in turn will lead to overall institutional stability hence a sound business environment.

Table 6. Correlation Analysis

		GDP	IPR	LR	U	PR	GE	PS	RQ	BU	TT
GDP	Pearson Correlation	1	0,19	0,11	-0,06	-0,48	0,24	-0,06	0,26	0,53	0,35
	Sig. (2-tailed)		0,54	0,73	0,86	0,1	0,43	0,86	0,38	0,06	0,25
Internet Penetration of population	Pearson Correlation	0,19	1	0,52	0,15	-.602*	0,43	0,17	0,38	0,4	.701**
	Sig. (2-tailed)	0,54		0,07	0,62	0,03	0,15	0,59	0,2	0,18	0,01
Literacy rate (LR)	Pearson Correlation	0,11	0,52	1	0,5	-.584*	0,31	0,14	0,11	0,36	.579*
	Sig. (2-tailed)	0,73	0,07		0,08	0,04	0,31	0,64	0,73	0,22	0,04
Unemployment (U)	Pearson Correlation	-0,06	0,15	0,5	1	-0,01	-0,43	-0,35	-.560*	-0,08	-0,03
	Sig. (2-tailed)	0,86	.620	0,08		0,97	0,15	0,25	0,05	0,8	0,93
Poverty Ratio (PR)	Pearson Correlation	-0,48	-.602*	-.584*	-0,01	1	-.793**	-.576*	-.709**	-.612*	-.734**
	Sig. (2-tailed)	0,1	0,03	0,04	0,97		0	0,04	0,01	0,03	0
Government effectiveness (GE)	Pearson Correlation	0,24	0,43	0,31	-0,43	-.793**	1	.711**	.961**	.705**	.789**
	Sig. (2-tailed)	0,43	0,15	0,31	0,15	0		0,01	0	0,01	0
Political Stability (PE)	Pearson Correlation	-0,06	0,17	0,14	-0,35	-.576*	.711**	1	.705**	0,42	0,43
	Sig. (2-tailed)	0,86	0,59	0,64	0,25	0,04	0,01		0,01	0,15	0,14
	Sig. (2-tailed)	0,75	0,24	0,4	0,08	0,01	0	0	0	0,01	0
Regulatory quality (RQ)	Pearson Correlation	0,26	0,38	0,11	-.560*	-.709**	.961**	.705**	1	.675*	.724**
	Sig. (2-tailed)	0,38	0,2	0,73	0,05	0,01	0	0,01		0,01	0,01
	Sig. (2-tailed)	0	0,04	0,21	0,95	0	0,02	0,52	0,03	0	0
Business Usage (BU)	Pearson Correlation	0,53	0,4	0,36	-0,08	-.612*	.705**	0,42	.675*	1	.860**
	Sig. (2-tailed)	0,06	0,18	0,22	0,8	0,03	0,01	0,15	0,01		0
	Sig. (2-tailed)	0,33	0,16	0,89	0,43	0,14	0,04	0,1	0,03	0,02	0,06
Technology transfer (TT)	Pearson Correlation	0,35	.701**	.579*	-0,03	-.734**	.789**	0,43	.724**	.860**	1
	Sig. (2-tailed)	0,25	0,01	0,04	0,93	0	0	0,14	0,01	0	

Poverty Ratio is highly correlated with Technology Transfer, with a weighting of -0.734 at a significance level of .004. Government Effectiveness is highly correlated with Political Stability (0.711); Regulatory Quality (0.961); Business Usage (-0.612) and Technology Transfer (-0.734). Political Stability is highly correlated with Regulatory Quality (0.705). Political Stability means that the government will be able to set clear and effective regulations that enable the general business environment. There will be sound and strong governance structures that will enable a conducive business environment. Regulatory Quality is highly correlated with Business Usage (0.675) and Technology Transfer (0.724). Thus, sound regulations will enhance the business

environment, protect consumer rights and therefore enable people to conduct business freely whether online or not. Finally, Business Usage is highly significant to Government Usage (0.624) and Technology Transfer (0.860). As individuals increasingly take up and use technology, businesses will more likely grow due to the increase in the demand for goods and services. The improvement in the business environment will enable more research and development in a country; hence the increase in technology development will drive demand for advanced technologies. As business improve and advance in technologies, so will the government as a partner in business.

Multiple Linear Regression Analysis

The results of the multiple regressions are presented in Table 7. The R2 measures the proportion of the variation in the DV (Business Usage) that was explained by the variations in the IV (Poverty Rate, Government Effectiveness, Regulatory Quality, Political Stability, Technology Transfer, Internet Penetration). Thus, 93% of the variation from the mean in the DV was explained. The adjusted R2 is the measure of the proportion of the variance in the DV (Business Usage) that was explained by the variations in the IVs. The standard error of estimate is 0.53, which is far less than 10% and therefore the dispersion of the DVs around the mean is low.

Table 7. Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R^2 Change	F Change	df1	df2	Sig. F Change	
1	.964	0.929	0.716	0.533007	0.929	4.36	9	3	0.126	1.913
a. Predictors: (Constant), Technology Transfer, Unemployment, GDP, Political Stability, Internet Penetration, Literacy Rate, Poverty Ratio, Government Effectiveness, Regulatory Quality										
b. Dependent Variable: Business Usage										

The model summary table shows that the multiple coefficient (R), using all the predictors simultaneously, is .964 (R2=.929) and adjusted R2 is .716 meaning that 72% of the variance in the DV (Business Usage or E-Commerce Adoption) can be predicted and explained by the IVs (Government Effectiveness, Literacy Rate, GDP, Internet Penetration (Technology Transfer) Unemployment, Regulatory Quality, Poverty Ratio and Political Stability). The higher value may be attributed to the decrease in the number of IVs. Therefore a conclusion was reached that the model is a good fit.

Coefficients Analysis

The Tables of Coefficients (Table 8) show the standardized beta coefficients, interpreted similarly to correlation coefficients. The t value and the sig opposite each IV indicates whether that variable is significantly contributing to the equation for predicting E-Commerce Adoption from the whole set of predictors. GDP, Literacy Rate, Unemployment and Poverty Rate are significantly contributing to the equation. However, all the variables need to be included in this result, since the F value was comput-

ed with all the variables in the equation. GDP explains the most variance at 84% (.9182), followed by at 80%, Unemployment (70%) and Literacy Rate (54%). Political Stability (38%), Regulatory Quality (26%) and finally Internet Penetration (14%) show the lowest amount of unique variance. Therefore, GDP, Literacy Rate, Unemployment, Poverty Ration explain E-Commerce Adoption more than other variables. Tolerance and VIF tell us if there is multi-collinearity problem. If tolerance is low (<1-R2), then there is a multi-collinearity problem. In this case, adjusted R2 is .842 and 1-.8422 is .29. Unemployment, Poverty Rate, Government Effectiveness and Regulatory Quality have tolerance levels lower than (1-R2), hence shows a multi-collinearity problem. However, as previous stated, these variables may be important in explaining the questions this research is answering..

Table 8. Coefficients

Model	Unstandardized Coefficients		Stand. Coeff.	*t*	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	*Beta*			Zero-order	Partial	Part	Tolerance	VIF
(Constant)	-0.254	0.153		-1.656	0.24					
GDP	2.597	1.112	2.775	2.334	0.145	0.534	0.855	0.27	0.009	105.955
Internet Penetration	2.302	1.327	1.689	1.735	0.225	0.396	0.775	0.2	0.014	71.041
Literacy Rate	0.319	0.369	0.315	0.864	0.479	0.363	0.521	0.1	0.1	9.981
Unemployment	2.996	1.393	2.757	2.151	0.164	-0.078	0.836	0.248	0.008	123.191
Poverty Ratio	3.628	1.555	3.02	2.333	0.145	-0.612	0.855	0.269	0.008	125.604
Government Effectiveness	-4.216	2.85	-3.85	-1.479	0.277	0.705	-0.723	-0.171	0.002	507.897
Political Stability	-1.094	0.908	-0.811	-1.204	0.352	0.419	-0.648	-0.139	0.029	34.027
Rule of Law	10.065	5.521	9.653	1.823	0.21	0.661	0.79	0.211	0	2101.529
Regulatory Quality	0.449	0.832	0.441	0.54	0.643	0.675	0.357	0.062	0.02	49.954
Technology Transfer	-3.323	2.158	-3.323	-1.539	0.264	0.86	-0.736	-0.178	0.003	349.218
a. Dependent Variable: Business Usage										

3.5 **Analysis of Hypotheses**

This section gives the analysis of results based on Table 8.

H11: Government policy influences adoption of e-commerce in a country

H10: Government policy does not influence adoption of e-commerce in a country

Literature supports the view that government stimulates technology adoption (Shin, 2007; Cordeiro & Al-Hawamdeh, 2001). However, despite literature support for government influence on e-commerce adoption, our analysis reveals a weak link. In our study, government policy was represented by Government Effectiveness and Political Stability. The p-values are .277 and .352, while the beta values are -3.850 and -.811 for Government Effectiveness and Political Stability respectively. All p-values are > 0.1 which shows that there is no relationship between Government Policy and E-

Commerce Adoption in the context of this study. However, there is some evidence that given some level of Technology Transfer and Internet Diffusion, Government Policy can influence adoption of e-commerce in a country. Therefore, the null hypothesis H11 is rejected and the alternative hypothesis H10 (government policy does not influence adoption of e-commerce adoption in a country) is accepted. In in line with the findings from the literature, it may be argued that the alternative hypothesis maybe accepted, taking into account sample size limitations. However, the correlation analysis revealed a high correlation between Government Effectiveness variables and E-Commerce Adoption at acceptable significance levels.

H21: Legal framework influences adoption of e-commerce in a country

H20: Legal framework does not influence adoption of e-commerce in a country

Regulatory Quality is the proxy for legal framework. The beta coefficient is .304 and the p-value is .797. However, when Technology Transfer and Internet Diffusion are incorporated, the beta coefficient increases to .904 and the significance level increases to .296. Again, the p-value is greater than .01 but there is an enormous difference caused by Technology Transfer and Internet Diffusion, hence we reject the null hypothesis H21 and accept the hypothesis H20, (legal framework does not have an influence on adoption of e-commerce in a country). Zhu and Thatcher (2010) show that the legal environment should reduce uncertainty by providing adequate, clear and efficient frameworks for economic exchange. If a government shows a clear commitment to e-commerce, this becomes apparent in its policy measures, which in turn can encourage e-commerce utilization (Molla & Licker 2005).

H31: Socio-cultural factors influence adoption of e-commerce in a country

H30: Socio-cultural factors do not influence adoption of e-commerce in a country

From the coefficients table, Socio-Cultural Factors as represented by Literacy Rate, Unemployment and Poverty Ratio have beta values of .382, .710 and 1.396, with p-values of .221, .040 and .022 respectively. Unemployment and Poverty Ratios show a strong positive relationship with E-Commerce Adoption. Introducing Technology Transfer and Internet Diffusion, beta values are 113, .503 and 1.075 for Literacy Rate, Unemployment and Poverty Ratio respectively, with significant values of .822, .347 and .351 respectively. This resulted in a significant decrease in the beta and p-values. This means that as the Unemployment and Poverty Ratio decrease in a country, the level of E-Commerce Adoption increases but bringing in Technology Transfer and Internet Diffusion suppresses the spread and use of e-commerce possibly due to the anticipated costs brought by new infrastructure that supports new technologies.

The results show that all the Socio-Cultural Factors may have an impact on E-Commerce Adoption. Therefore, we reject the null hypothesis, H30 and accept H31 (socio-cultural factors contribute positively to the adoption of e-commerce in a country). The level of influence is quite high looking at the p-value of the significant variables. Several socio-cultural factors have been identified as barriers to e-commerce adoption in developing countries.

H41: Internet diffusion influences adoption of e-commerce in a country

H40: Internet diffusion does not influence adoption of e-commerce in a country

The results in the regression analysis show that Internet Diffusion has a significance level of .181 on e-commerce with the adjusted R2 of .080 and the beta value of

.396. Using the significance level of .10, H41 is rejected thereby inferring that at the conceptual level, there is no relationship between Internet Diffusion and E-Commerce Adoption. Given the small sample size and data issues, this result can be questioned. Literature shows that there is a positive relationship between Internet Diffusion and E-Commerce Adoption as an artefact of technology [9].

H51: Technology transfer influences adoption of e-commerce adoption in a country
H50: Technology transfer does not influence adoption of e-commerce adoption in a country

Technology Transfer, tested in isolation from the other variables, was found to have the most significance on E-Commerce Adoption. This was shown by the p-value of .000 and the beta value of 5.581. However, when combined with all other predictor variables, the p-value decreases to .126. Based on the literature, Technology Transfer is believed to have an influence on E-Commerce Adoption in a country [4]. Therefore, the null hypothesis H50 is rejected and we find (H51) Technology Transfer does have an impact on E-Commerce Adoption in a country.

4 Conclusions

A model for e-commerce adoption incorporating Internet diffusion and technology transfer as mediating factors was developed. All variables were tested together to determine their impact on e-commerce adoption. The study found that GDP, socio-cultural factors, technology transfer had a significant impact on e-commerce adoption. This study revealed that government policy, legal environment, socio-economic framework, Internet diffusion, technology transfer could affect the adoption of e-commerce in a developing country. Given the context of Sub-Saharan Africa, particularly the SADC region which has for many years been affected by political instability, poverty, corruption, riots, poor infrastructure, unemployment and high illiteracy rates, the findings reveal that all variables could contribute to e-commerce adoption to some extent as shown by a strong contribution by socio-cultural factors and GDP. This can be validated by the fact that more studies revealed the opposite in developed countries, which are affected less by the conditions prevailing in the developing world.

The proposed model has identified the link between national ecology factors (particularly the social-cultural construct), Internet diffusion and technology transfer with e-commerce adoption. It has shown that socio-cultural issues contribute more than any other factors to the adoption of e-commerce. A somewhat small effect was realised from technology transfer and Internet diffusion. More research is needed to identify other factors that could have an impact on e-commerce adoption. The analysis confirmed that the socio-cultural infrastructure is a critical factor in enabling e-commerce adoption, when technology transfer influence is taken into account. The socio-cultural context emphasizes the need to build the Social Capital or Social Resources required for stimulating e-commerce adoption.

Reference

1. Zhu L., Thatcher S.M.B. National Information ecology: a new institutional economic perspective on global e-commerce adoption // Journal of electronic commerce research, Vol. 11, No. 1, 2010. pp. 53-71.
2. Siyal M.Y., Chowdhry B.S., Rajput A.Q. Socio-economic factors and their influence on the adoption of e-commerce by comsumers in singapore // International Journal of Information Technology & Decision Making, Vol. 50, No. 2, 2006. pp. 317-329.
3. Ochara N.M., Krauss K. Towards a Collaborative E-Business Vision for Africa // In: Strategic and Pragmatic E-Business: Implications for Future Business Practices. Hershey, PA: IGI Global, 2012. pp. 396-414.
4. Kumar U., Kumar V., Dutta S., Fantazy K. State sponsored large scale technology transfer projects in a developing country context // The Journal of Technology Transfer, Vol. 32, No. 6, 2007. pp. 629-644.
5. Chang Y.C., Shih C.T., Chieng W.C., Su C. Evaluating impacts of the MNE R&D Centre Programme on the national innovation system in Taiwan // Research Evaluation, Vol. 19, No. 1, 2010. pp. 67-79.
6. Rogerson C.M., Rogerson J.M. Improving the local business environment of Johannesburg. // Development Southern Africa, Vol. 27, No. 4, 2010. pp. 577-593.
7. Molla A., Licker P.S. Perceived e-readiness factors in e-commerce adoption: an empirical investigation in a developing country // International Journal of Electronic Commerce, Vol. 10, No. 1, 2005. pp. 83-110.
8. Leech L.N., Barret C.K., Morgan A.G. IBM SOSS for Intermediate Statistics and Interpretation. 4th ed. New York: Rutledge, Taylor and Francis Group, 2011.
9. Amougou J., Larson J.S. Comparing implementation of internet diffusion in the United States and France: Policies, beliefs, and institutions // Review of Policy Research, Vol. 25, No. 6, 2008. pp. 563-578.
10. Hall B.H., Khan B. Adoption of new technology (No. w9730). National Bureau of Economic Research, 2003.
11. Thurasamy R., Mohamad O., Omar A., Marimuthu M. Technology Adoption Among Small And Medium Enterprises (SME's): A Research Agenda. 2009.
12. Zhao H., Kim S., Suh T., Du J..Social institutional explanations of global internet diffusion: a cross-country analysis // Journal of Global Information Management, Vol. 15, No. 2, 2007. pp. 28-55.
13. Venkatesh V., Goyal S. Expectation disconfirmation and technology adoption: polynomial modeling and response surface analysis // MIS quarterly, Vol. 34, No. 2, 2010. pp. 281-303.
14. Van Ittersum K., Feinberg F. Cumulative timed intent: A new predictive tool for technology adoption. // Journal of Marketing Research, Vol. 47, 2010. pp. 808-822.
15. Slyke C.V., Bélanger F., Johnson R.D., Hightower R. Gender-based differences in consumer e-commerce adoption // Communications of the Association for Information Systems, Vol. 26, No. 1, 2010. P. 2.
16. Shin D.H. A critique of Korean National Information Strategy: Case of national information infrastructures // Government Information Quarterly, Vol. 24, No. 3, 2007. pp. 624-645.
17. Walden E.A., Browne G.J. Sequential adoption theory: a theory for understanding herding behavior in early adoption of novel technologies. // Journal of the Association for Information Systems, Vol. 10, No. 1, 2009. pp. 31-62.
18. Davis F.D., Bagozzi R.P., Warshaw P.R. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models // Management Science, Vol. 35, No. 8, 1989. pp. 982-1002.
19. Rogers E.M. Diffusion of innovations. 5th ed. New York: Free Press, 2003.

20. Brown S.A., Venkatesh V., Bala H. Household technology use: Integrating household life cycle and the model of adoption of technology in households // The Information Society, Vol. 22, No. 4, 2006. pp. 205-218.
21. Pires G.D., Aisbett J. The relationship between technology adoption and strategy in business-to-business markets: the case of e-commerce // Industrial Marketing Management, Vol. 32, No. 4, 2003. pp. 291-300.
22. Hee Jun C. Technology Transfer Issues and a New Technology Transfer Model // Journal Of Technology Studies, Vol. 35, No. 1, 2009. pp. 49-57.
23. Lundvall B.A., Maskell P. Nation States and Economic Development - From National Systems of Production to National Systems of Knowledge Creation and Learning // In: The Oxford handbook of economic geography. Oxford: Oxford University Press, 2000. pp. 353–372.
24. Fromhold-Eisebith M. Bridging scales in innovation policies: How to link regional, national and international innovation systems // European Planning Studies, Vol. 15, No. 2, 2007. pp. 217-233.
25. Zwass V. Electronic commerce: structures and issues // International journal of electronic commerce, Vol. 1, 1996. pp. 3-24.
26. Huang J., Zhao C., Li J. An empirical study on critical success factors for electronic commerce in the Chinese publishing industry // Frontiers of Business Research in China, Vol. 1, No. 1, 2007. pp. 50-66.
27. Akinboade A.O., Lalthapersad-Pillay P. The NEPAD initiative and the prospects of business opportunities in the rest of Africa for South African firms based in Gauteng. // Development Southern Africa, Vol. 26, No. 1, 2009. pp. 131-155.
28. Cordeiro C.M., Al-Hawamdeh S. National Information Infrastructure and the realization of Singapore IT2000 initiative. // Information Research, Vol. 6, No. 2, 2001.
29. Richter R. The new institutional economics: its start, its meaning, its prospects // European Business Organization Law Review, Vol. 6, No. 2, 2005. pp. 161-200.
30. Williamson O.E. The new institutional economics: taking stock, looking ahead // Journal of economic literature, Vol. 38, No. 3, 2000. pp. 595-613.
31. Dutta S., Bilbao-Osorio B. The Global information technology report 2012: Living in a hyperconnected world., 2012.