

**STRUCTURAL EQUATION MODELING OF SUPPLY CHAIN
MANAGEMENT PRACTICES ON RELATIONSHIP BETWEEN
ADOPTION OF E-PROCUREMENT AND SUPPLY CHAIN
PERFORMANCE IN MANUFACTURING FIRMS IN KENYA**

Ezekiel K. Chirchir

School of Business & Economics, Moi University, Box 3900 Eldoret,

Abstract

As the world's economy becomes increasingly competitive, sustaining competitiveness and the resulting profitability depend largely on how firms manage their performance. The increasing global trend toward purchasing from outside the organization has brought about challenges in the supply chain. To overcome the supply chain problems some manufacturing firms have opted to implement electronic procurement as a strategy to improve their performance. The main purpose of this study was to investigate the mediating effect of supply chain management practices on the relationship between e-procurement adoption and supply chain performance. The study was guided by Diffusion of Innovation Theory, Resource Based Theory and Technology-Organization-Environment framework. An explanatory research design was adopted during the study. The target population was 4200 respondents from 12 manufacturing firms and suppliers. Purposive and proportional sampling was used to select a sample size of 365 respondents comprising of staff, managers and suppliers. Questionnaires and structured interview schedule was used to collect data. Structural equation modelling was used to determine the mediating effect of supply chain management practices on the relationship between the adoption of e-procurement and supply chain performance. The total indirect effect of supply chain performance on supply chain performance was 0.289 compared to the direct effect of 0.121. The total effect of supply chain performance on supply chain performance was 0.410. There was a significant partial mediation effect of the adoption of e-procurement on the supply chain performance via information sharing, partnership and integration mediators. Manufacturing firms should therefore embrace both E-procurement adoption and supply chain management practices to enhance supply chain performance in their firms. Stakeholders will find the research findings useful in diagnosing the problems bedeviling the manufacturing firms and therefore make sound critical decisions regarding e-procurement for overall supply chain performance.

Keywords: Supply, Chain, Management, Practices, Adoption, Electronic Procurement, Performance, Manufacturing, Firms

Introduction

Supply chain performance refers to the evaluation of supply chain management, and includes both tangible (e.g. cost) and intangible (e.g. capacity utilization) factors (Croom and Johnson, 2003; Eng, 2004; Presutti, 2003; Tan, Lyman, & Wisner, 2002). Supply Chain Performance is the extent that supply chain activities are meeting end-customer requirements,

including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner. Supply chain performance enables firms to drive rapid change in all aspects of operations.

Supply Chain Management has become an essential prerequisite to stay in the competitive global environment for profitability especially for profit government corporations and entities (Thai, 2009). As the world's economy becomes increasingly competitive, sustaining competitiveness and the resulting profitability depend less on the ability to raise prices (Presutti, 2003). Those competitive dimensions cannot be delivered without an effectively managed supply chain. Firms with the most competitive supply chains are and will continue to be the big winners in contemporary business world. Procurement is part of supply chain management activities and has exploded into the business scene as one of corporate management's major concerns over the past decades. According to Presutti,(2003) almost 70% of a firm's sales revenues is, on average, spent on supply chain-related activities from material purchases to the distribution of goods and services of finished products to the end customers.

E-procurement creates a higher profile for supply management and boosts its visibility to top management (Presutti, 2003). E-procurement phenomenon that started in the developed economies but due to the spread of the internet, it has been increasingly adopted in the developing world. The increasing emphasis on supply chain management has created a greater focus on the supply management link in the supply chain. E-procurement among the supply-side activities that have been identified as a key area where information systems enabled innovations are likely to yield significant benefits for organizations (European Commission, 2012). The advent of the internet has definitely made a change in the modern way of procurement functions. The role of procurement has changed considerably due to advancement in information technologies and information systems. However, there is a looming gap currently existing in our understanding of the role of procurement in our organizations today (Brook, 2002).

Battenberg (2007) conducted study on e-procurement option by European firms and identify country differences in e-procurement adoption, and that firms from countries with a low uncertainty avoidance such as Germany and the UK are the early adopters of e-procurement, while countries that are less reluctant to change such as Spain and France have lower adoption rates. The global perspective of e-procurement adopted from the Transparency International (2006) shows that it has helped Brazil in sharing of information between the procuring entities and supplying firms. In Malaysia, e-procurement has been in use since December 2004 when the Malaysian treasury issued new guidelines for public procurement on infrastructure maintenance projects. More emphasis was put on the use of open e-procurement competitive tenders to curb corruption. Entrepreneurs are now able to submit bids online on anywhere and anytime basis for government contracts and sell products or expertise to government agencies through the e-procurement portal (Mrisho, 2010). Despite these benefits no industry is left untouched, in today's customer-focused market place; supply chain management has become a key to competitive advantage (Grieger, 2003).

E-procurement is one of the most world existing developments in supply chain management in modern times. However, in most African countries, the ultimate e- procurement system is still in the development stage and will evolve over time (Bardi, Coyle and Langley, 2013). Greunen, *et al.*, (2010), found that measurable benefits of supply chain management has not yet been realized due to general limited understanding of how supply chain management concept works within government environment in South Africa. Procuring entities today are continuously facing external and internal problems when sourcing for their needs by the use of traditional procurement procedures. In order for organizations to be competitive and stay updated, there is need to have a paradigm shift in the way procurement is carried out so as to solve numerous procurement problems evident in the business world especially in developing economies which include increased corruption, high costs of doing businesses, a lot of non-value adding paperwork procedures, long time elapse to respond to tenders and non-competitiveness (CIPS,2011) and indeed Gineret *al.*, (2011)confirms that a properly implemented-procurement system can connect companies and their business processes directly with suppliers while managing all inter actions between them. Ago ode-procurement system helps a firm organize it's in tractions with its most crucial suppliers.

Procurement is part of supply chain management activities. In general, supply chain management has been exploded onto the business scene as one of corporate management's major concerns over the past decades. The procurement function has been characterized by corruptions can dales and indignity which have been attributed to poor handling of procurement information thus leading to excessive corruption (Thai, 2009). There is need to have a robust automated procurement system which is inter linked and this will lead to enhanced compete divines sand lowered costs (Ogotet *al.*, 2009). Several works hop sand seminars have been held within the procurement function to improve the performance of the supply chain but they have in adequately addressee dhow e-procurement adoption can enhance supply chain performance through partner relationship, information sharing and supply chain in titration with in supply chain system (PPOA,2010).Weak ICT infrastructure and it sad option in support of e-procurements challenge to procurement (Imbugaet *al.*, 2011). Major change s are currently taking place within procurement (purchasing) functions of manufacturing firms. Procurement is shifting its focus from daily procurement activities to long term, value-adding purchasing and supply chain initiatives. At the same time, it is responding to the challenges and opportunities of electronic procurement.

Al though Leung (2007) has evaluated information sharing one-procurement, he has not given emphasis on supply chain performance and this needed to be investigated. The core mandate of Public Procurement Oversight Authority (PPOA) is e-procurement system that is deployed to it. Once this is implemented and linked to procurement entities, it becomes a tool for the compliance function in the monitoring and evaluation of procurement entities (PPOA, 201). Many firms in Kenya and the world have registered dismal supply chain performance in terms of partner relationship, information sharing, supply chain in titration and supplier appraisal with in supply chain system because of the in efficient and unsustainable procurement procedures as it has been witness se din the Kenyan Public sector. Procurement is recognized as a support

function that provides for the sourcing needs of other departments. The responsibilities of procurement have changed markedly over the last few decades. It focuses heavily on the transactional elements of the procurement process. In some situations employees have been fired because of low performance rate, persistent lateness and wrong attitude to work (Weele,2005). This calls for the need to critically look at the mediating effect of supply chain management practices on the relationship between-procurement adoption and supply chain performance.

There are local studies that have been carried out in e-procurement. These includes; Orori (2011) on factors that influence the introduction of e-procurement in retail industry: a survey of retail chain supermarkets in Kenya; Njoroge (2010) on factors influencing e-procurement practices in construction industry in Kenya and Mburu (2011) on the role of e-procurement in enhancing efficiency in telecommunication industry (A Case Study of Safaricom Limited Company-Kenya). Kiprono (2013) indicates that the main impediment to e-procurement adoption in manufacturing firms in Kenya is a “wait-and-see” attitude among firms. This happens in selecting e-market places and procurement service providers which has significantly hampered supply chain performance. It is however clear that the studies have not focused on the effect of supply chain management practices on the relationship between e-procurement adoption and supply chain performance in manufacturing firms in Kenya. To address this gap, this study focused on the mediating effect of supply chain management practices on the relationship between e-procurement adoption and supply chain performance in manufacturing firms in Kenya.

Theoretical Framework

The study adopted Diffusion of Innovation (DOI) theory (Hsu, Kraemer & Dunkle 2006) and Resource-Based View (RBV)theory(Zhu & Kraemer, 2005 to explain the effect of e-procurement adoption on supply chain performance in manufacturing firms. The technological context is addressed by both DOI theory and RBV theory. Diffusion of innovation theory by Rogers (2003) describes the process of spreading an innovation via communication channels overtime among the members of a social system. Roger’s theory details the stages of the innovation decision process (knowledge, persuasion, decision, implementation, and confirmation). The communication channels are mass media channels (e.g., radio and newspapers) and interpersonal, interactive channels (such as in face-to-face communication). It is common to draw distinction between process and variance theories: theories describing typical stages of a process and theories hypo the sizing cause-effect relationships between variables (Gregor, 2006).The members of a social system, the potential adopters, could be individuals, informal groups, or organizations. When the adopter is an organization, along with the attributes of the organization’s lead eras an adopter, DOI theory suggests that organizational structure (e.g. centralization, complexity, and formalization) and organizational openness (links to other organizations) affect the rate of adoption.

RBV theory suggests that firms create value by combining resources, both tangible and in tangible along with the term resources. The value of a particular resource may depend on the presence of other, related resources (MohdSalleh, 2009). RBV the or distinguishes physical

capital sources, human capital sources, and organizational capital sources. Information technology can be seen as a physical capital resource. Training, experience, judgment, intelligence, relationships, and insight of indivisible managers and workers in a firm (all highly relevant to managing innovation and technology) are human capital resources. The structure of a firm is both affected and supported by its information systems and the firm's relationships with other firms may involve sharing information in digital form and inter-organizational system integration. Siring as an, *et al.*, (2002), in a survey of companies in multiple industries in the US, found that the adoption and use of e-business was influenced by the technological capabilities of the firms. RBV theory has been criticized for being not specific enough in defining various types of resources; Prime and Butler (2001) argued that key definitions varied from study to study, with the resulting inconsistency hindering the accumulation of knowledge. Arguably, RBV theory addresses this context in a rather limited way, as the environment cannot be viewed solely as a resource, but also presents constraints and threats. DOI theory explicitly targets explaining technology adoption and addresses all the three contexts and it simply considers technology as a physical capital resource that can be used to generate sustained competitive advantage. This theory suggests the specific attributes of an innovation (applicable to technology innovation) relevant to decisions regarding adoption and use. Both DOI theory and RBV theory addressed organizational context and are similar in terms of modelling the organizational context, because from the perspective of RBV theory, the aspects of organizational structure claimed by DOI theory to affect adoption and use can be seen as human capital and intra-organizational capital resources.

Conceptual Framework

The conceptual framework showed the proposed relationship between e-procurement adoption and supply chain performance. The e-procurement adoption was the independent variable. The dependent variable was supply chain performance represented (measured) by competitive products, competitive prices, short lead time and other competitive terms and conditions. The mediator variable was the supply chain management practices represented by partner relationship, information sharing, and supply chain integration. The study conceptualized that there was inter-relationship between the three variables as shown in Figure 1.

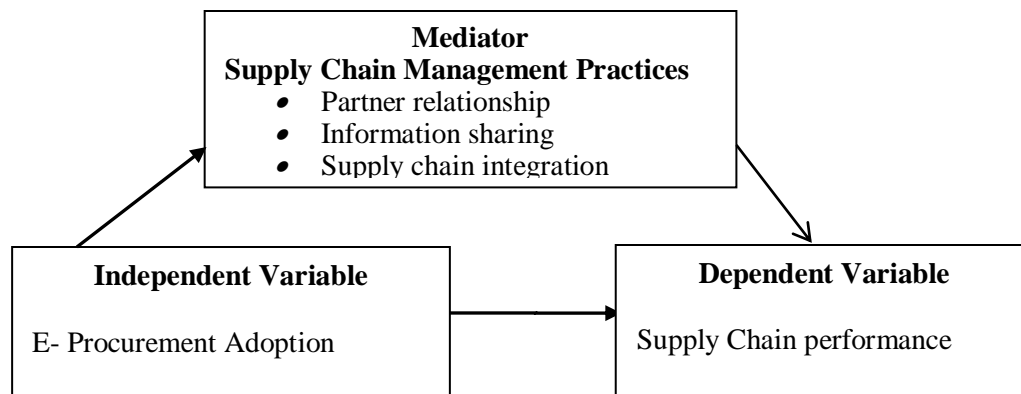


Figure 1: Conceptual Framework depicting e-procurement adoption and supply chain performance mediated by supply chain management practices

The firm enhanced trust in the line of business, firm debriefs suppliers after every evaluation and if manufacturing firms had partner relationship with suppliers used electronic procurement sought. In mediation, the supply chain management practices helps explain how or why an adoption of e-procurement influences supply chain performances directly or indirectly. In the context of this study, it is often of great interest to identify the supply chain management practices by which manufacturing firms achieves its effect. By investigating mediational processes that clarify how e-procurement achieves the study outcome, not only understand of the effect of e-procurement adoption and the supply chain performances, but also be able to identify more efficient, supply chain management practices. With mediation analysis, an insight of supply chain management practices is obtained. This gives an added dimension to understand the e-procurement adoption and the pathways of supply chain performances, which can stimulate more efficacious supply chain management practices.

Research Methodology

The study adopted explanatory research design which implies that the research in question is intended to explain, rather than simply to describe (Maxwell & Mittapalli 2008). Traditionally, the explanatory research has been quantitative in nature and hypotheses tested by measuring the relationships between variables, while data is analyzed using statistical techniques which attempt to identify causal relationships through the analysis of correlations between variables (Maxwell & Mittapalli 2008). The research design was found suitable because the study was mainly concerned with quantifying a relationship or comparing groups purposely to identify a cause-effect relationship.

The study purposively targeted twelve (12) manufacturing firms from which respondents were selected proportionately from the following cadres; personnel in administration, supply chain departments, top management and suppliers. The target population was 4200 respondents from which the study sample was obtained. All the manufacturing firms were sampled in the study to yield a saturated sample, because the firms considered were few to necessitate any sampling. Line managers and staff in the procurement, administration departments and suppliers were sampled purposively as summarized in Table 2. Using Yamane’s (1967), sample size at 95% confidence level, P = 0.05, the sample size was computed as hereunder:

$$n = \frac{N}{1 + N(e)^2} = 4200/1+4200(.05)^2 = 365 \text{ respondents}$$

Where; n = the sample size, N = the population size, e= the acceptance sampling error

The research study was based on the primary and secondary data collected. Primary data was collected directly from the respondents using questionnaires and structured interviews as the

main source of data while secondary data used was from supply chain performance records where company’s annual records and reports were assessed and tabulated. Questionnaires and structured interview schedule were used to gather information.

The researcher used expert opinion to assess the validity of the data collection tools. The suggestions were used as a basis to modify the research items to make them adaptable to the study. The questionnaires were assessed for their reliability through a pilot study. Cranach’s coefficient alpha was used to determine the reliability of the research instrument, where a reliability coefficient of 0.7 and above was assumed to reflect the internal reliability of the instruments (Fraenkel & Wallen, 2000). The questionnaires were deemed reliable after many typographical errors and omissions detected were corrected in the instrument confirming that it was sufficient to be used in the main study. After data collection, responses from all questionnaires and interview schedule items were cross-checked to facilitate coding and processing for analysis using AMOS (Version 22.0) Computer programme. The findings presented using frequency tables. Structural Equation Modelling (SEM) was used to establish mediation effect. Structural equation modelling (SEM) is a very general and powerful multivariate technique which uses a conceptual model, path diagram and system of linked regression-style equations to capture complex and dynamic relationships within a web of observed and unobserved variables (Bollen 1989 and Kowalski & Tu 2007).

SEM is fundamentally different from regression. In a regression model, there exists a clear distinction between dependent and independent variables. In SEM, however, such concepts only apply in relative terms since a dependent variable in one model equation can become an independent variable in other components of the SEM system. It is precisely this type of reciprocal role a variable plays that enables SEM to infer causal relationships. SEM is an extension of the General Linear Model (GLM) that enables a researcher to test a set of regression equations simultaneously. SEM software can test traditional models, but it also permits examination of more complex relationships and models, such as confirmatory factor analysis and time series analyses. The model consists of a set of relationships among the measured variables. These relationships are then expressed as restrictions on the total set of possible relationships. The study examined a reduced regression model without the mediator:

$$Y_i = \beta^*_0 + \beta^*_{xy}X_i + \varepsilon^*_{yi} \dots \dots \dots 3.1$$

The null hypothesis was accepted if ($H_{01}: \beta^*_{xy} = 0$) for the reduced regression equation which showed that x and y (i.e. the intervention and the outcome) are not related and we should not consider potential mediators. SEM being a multivariate extension of the multiple linear regression models with one dependent (Y) variable, given i^{th} observations, ($1 \leq i \leq n$) yields equations below. These two structural equations are linked together and inference about them is simultaneous, unlike two independent standard regression equations and hence both equations 3.2 and 3.3 below:

$$Z_i = \beta_0 + \beta_{XZ}X_i + \varepsilon_{zi} \dots \dots \dots 3.2$$

$$Y_i = \beta_0 + \beta_{xy} X_{ii} + \beta_{zy} Z_i + \epsilon_{yi} \dots \dots \dots 3.3$$

Where:

Z_i is a vector containing observed scores on the dependent variable,

β_0 is a vector of 1's representing the y-intercept (constant),

X_i is a matrix of continuously distributed or categorical (dummy-coded) independent variables,

β_{xz} is the vector of regression weights, and

ϵ represents the vector of residual (or error) scoring unexplained by the model.

During this study three variables were involved and the path diagram showed the relationship that may exist between the supply chain management practices, supply chain performance and the e- procurement adoption. We assume the error terms are uncorrelated, an important assumption for causal inference in performing mediation analysis (Bollen & Pearl 2012 and Imai, Keele & Tingly 2010). The study assumed multivariate normality for the error terms; which is a necessary underlying condition of the definition of direct, indirect and total effects.

The assumption for casual inference in performing mediation analysis, assumed that the error terms are not correlated. A variable was considered a mediator to the extent to which it carries the influence of a given independent variable (IV) to a given dependent variable (DV). Mediation was said to occur when: (i) the IV significantly affects the mediator, (ii) the IV significantly affects the DV in the absence of the mediator, (iii) the mediator has a significant unique effect on the DV; and (iv) the effect of the IV on the DV shrinks upon the addition of the mediator to the model.

Results

The objective of the study was to establish the mediating effect of supply chain management practices (partnership, information sharing and supply chain integration) on the relationship between e-procurement adoption and supply chain performance in manufacturing firms. This was established using Structural Equation model (SEM). Typically, a hypothesized model was tested with a linear equation system through SEM. It was more versatile than other multivariate techniques as it allowed simultaneous, multiple dependent relationships between variables. The raw data for the variables were inputted into the AMOS software to generate the iterations, goodness-of-fit indices and standardized paths in order to generate structural equation models.

Tests of Absolute and Relative Fit

The SEM analysis indicated that a minimum was achieved with no errors or warnings. The chi-square test of overall model fit was found to be 46.483 with 3 degrees of freedom, returning a probability value of less than 0.001 as shown in table 1. Since the probability value of the chi-square test is smaller than the 0.05 level used by convention, the null hypothesis was rejected that the model fits the data.

Table 1: Test of Absolute Fit

Minimum was achieved	
Chi-square	46.483
Degrees of freedom	3
Probability level	0.000

This conclusion was not good to fit this model to the dataset used in the study. Therefore, the significant chi-square test indicated that actual and predicted inputs were statistically different. The chi-square test of absolute model fit is sensitive to sample size and non-normality in the underlying distribution of the input variables. The researcher turns to various descriptive fit statistics to assess the overall fit model to the data. There are several indicators of goodness-of-fit and most SEM scholars recommend in evaluating the models by observing more than one of these indicators (Bentler & Wu, 2002). Therefore, the commonly applied fit indices were Non-Normed Fit Index (NNFI), also known as the Tucker-Lewis index (TLI) and comparative fit index (CFI) (>0.90 indicates good fit), root mean squared approximation (RMSEA) (<0.08 indicates acceptable fit) as summarized in table 2.

From the study the NNFI was 0.526, which indicated a ‘bad fit’ for the hypothesized model. Since the hypothesized model did not have a ‘good fit’, it was rejected. The CFI = 0.858 which indicated an ‘acceptable fit’ for the hypothesized model. This finding agrees with Bentler (1990) who developed the CFI as a non-centrality parameter-based index to overcome the limitation of sample size effects, with 0.90 or greater representing an acceptable fit. RMSEA was an extremely informative criterion in evaluating model fit. The RMSEA was 0.231 which indicated a ‘bad fit’ for the hypothesized model. Since the hypothesized model did not have a ‘good fit’, it was rejected.

Table 2: Model Fit Summary

CMIN					
Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	17	46.483	3	0.000	15.494
Saturated model	20	0.000	0		
Independence model	10	315.692	10	0.000	31.569

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	0.853	0.509	0.861	0.526	0.858
Saturated model	1.000		1.000		1.000
Independence model	0.000	0.000	0.000	0.000	0.000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0.231	0.175	0.292	0.000
Independence model	0.336	0.305	0.368	0.000

AIC

Model	AIC	BCC
Default model	80.483	81.252
Saturated model	40.000	40.906
Independence model	335.692	336.145

Key:

NNFI=Non-Nor med Fit Index, TLI= Tucker-Lewis index, CFI= Comparative Fit Index, RMSEA= Root Mean Squared Errors Approximation, NNFI= Non-Normed Fit Index

Modifying the Model to Obtain Superior Goodness of Fit

It is rare that a model fits well at first analysis and model modification is required to obtain a better-fitting model. Modification indices (MIs) were used to add arrows to the model. The larger the MI, the more arrows were added to the model to improve its model fit. All possible variances were estimated, so that there were no un-modeled variances that could be estimated in a modified or revised model. There were some possible regression weights and covariance that were incorporated into a re-specified model that resulted in substantial changes in the model fit chi-square test statistic. The largest modification index values were found in the residual covariance. From the modification index, the covariance of e_4 with e_2 is expected to be 0.078 if you re-specify the model, with that covariance added and then refit the model as shown in Table 3.

**Table 3: Modification Indices (Group number 1 - Default model)
Covariance: (Group number 1 - Default model)**

	M.I.	Par Change
e_4 <--> e_2	14.922	0.078

Source: Survey Data, 2015

From this study, the MIs were so small that no addition of arrows was warranted. The model's chi-square test of overall fit was approximately 16.89 units lower than the present model's value of 46.48. Inclusion of the two correlated residuals results in a substantial drop in the model fit chi-square from 46.48 to 16.89 as shown in Table 4.

Table 4: Modified Test of Absolute Fit

Minimum was achieved	
Chi-square	16.889

Degrees of freedom	1
Probability level	0.000

The degrees of freedom chi-square test was reduced from three degrees of freedom to one degree of freedom. The one degree of freedom change occurs because each parameter estimated by the model consumes one degree of freedom; since two new parameters was included in the modified model (the two residual correlations), the new model had two fewer degrees of freedom remaining. The chi-square value of 16.89 with one degree of freedom was significant at the.05 level ($p=.000$). This finding suggests that the model does not fit the data acceptably in the population from which sample was drawn. There was a limitation to the chi-square test, since it was highly sensitive to sample size especially when the observations were greater than 200 and in this study 272 respondents were used. Although there is little consensus on the recommended sample size for SEM (Sivoet al., 2006), proposed a ‘critical sample size’ of 200. An alternate evaluation of the χ^2 statistic was to examine the ratio of χ^2 to the degrees of freedom (df) for the model (Joreskog & Sorbom, 1993).

The χ^2 value was 16.89 based on 1 df and probability value (ρ) for χ^2 statistic was less than 0.001. The findings disagree with Kline (2005) who suggestion that a χ^2/df ratio of 3 or less is a reasonably good indicator of model fit. As indicated in these results, the goodness of fit measures for the hypothesized model did not come near the minimum requirements for the benchmark fit indices as summarized in Table 5.

Table 5: Modified Model Fit Summary

CMIN					
Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	19	16.889	1	.000	16.889
Saturated model	20	.000	0		
Independence model	10	315.692	10	.000	31.569
Baseline Comparisons					
Model	NFIDelta1	RFIrho1	IFIDelta2	TLIrho2	CFI
Default model	.947	.465	.950	.480	.948
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000
RMSEA					
Model	RMSEA	LO 90	HI 90	PCLOSE	
Default model	.242	.150	.350	.001	
Independence model	.336	.305	.368	.000	
AIC					
Model	AIC		BCC		
Default model	54.889		55.749		

Saturated model	40.000	40.906
Independence model	335.692	336.145

Key:

NNFI=Non-Normed Fit Index (TLI = Tucker-Lewis Index), CFI= Comparative Fit Index, RMSEA= Root Mean Squared Errors of Approximation.

Substantiating the evidence provided by the RMSEA fit statistic, the obtained value of .242 was well above the desired .06 cutoff. Similarly, the Tucker-Lewis Index result of .480 was considerably below the .95 threshold denoting unsatisfactory firm model fit. In terms of a model’s goodness-of-fit, p-values indicated whether the model was significantly different than the null model. The null hypothesis was the hypothesized model in which the parameters were set up for the hypothesized model, indicating whether a path should exist or not between variables. A high p-value, or a value larger than zero, would mean that the null hypothesis is rejected leading to a high probability that it would be wrong in doing so (MacLean & Gray, 2001). Since the NNFI (TLI) = 0.480, CFI = .948 and RMSEA = 0.242 which indicated a ‘bad fit’ for the hypothesized model did not have a ‘good fit’, it was rejected.

Structural Equation Model Total Effects

Path coefficients was used to decompose correlations in the model into direct and indirect effects, corresponding, to direct and indirect paths reflected in the arrows in the model as shown in Figure 2. A path coefficient is a standardized regression coefficient (beta) showing the direct effect of an independent variable on a dependent variable in the path model. A path model is a diagram relating independent, intermediary, and dependent variables.

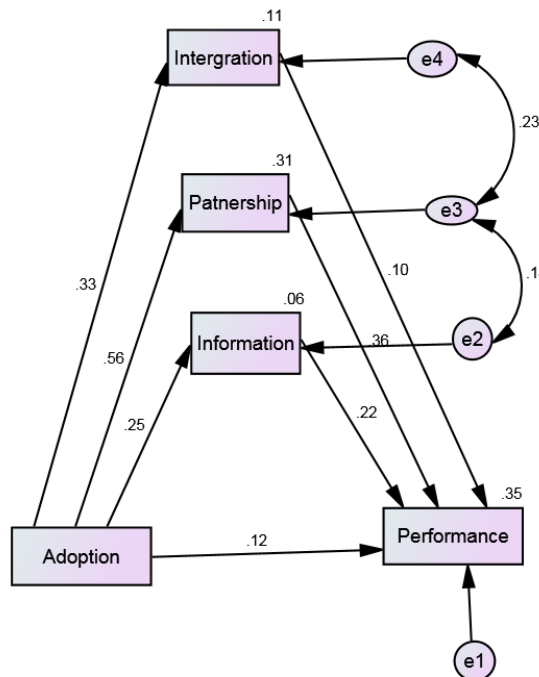


Figure 2: Path Diagram

Thus when the model has two or more causal variables, path coefficients are partial regression coefficients which measure the extent of effect of one variable on another in the path model controlling for other prior variables, using standardized data or a correlation matrix as input. Therefore, considering supply chain performance as the dependent variable in the model and e-procurement adoption as the independent variable, the indirect effects were calculated by multiplying the path coefficients for each path from e-procurement adoption to supply chain performance. The results of the three indirect path coefficients are summarized in Table 6.

Table 6: Indirect Path Coefficients

Path	Path coefficient	Product
Adoption -> integration-> performance	.33*.10	= 0.033
Adoption -> partnership-> performance	.56*.36	= 0.2016
Adoption -> information-> performance	.25*.22	= 0.055
Total Indirect Effect		0.2896

From the study the total indirect effect of e-procurement adoption on supply chain performance was 0.2896 while the direct effect was only 0.121. Therefore, total causal effect of e-procurement adoption on supply chain performance is $(.121 + .2896) = 0.410$ as shown in table 7. The results indicated that the supply chain partnership, information sharing and integration variables partially mediates the relationship between e-procurement adoption and supply chain performance. The higher the supply chain partnership, information sharing and integration mediation on e-procurement adoption the more the increase on supply chain performance in manufacturing firms. Thereby, the success of manufacturing firms is dependent on the level of supply chain management practices and e-procurement adoption.

Table 7: Total Effects (Group number 1 - Default model)

Standardized Total Effects (Group number 1 - Default model)

	Adoption	Information	Partnership	Integration
Information	.247	.000	.000	.000
Partnership	.558	.000	.000	.000
Integration	.332	.000	.000	.000
Performance	.410	.217	.362	.099

Standardized Direct Effects (Group number 1 - Default model)

	Adoption	Information	Partnership	Integration
Information	.247	.000	.000	.000
Partnership	.558	.000	.000	.000

Integration	.332	.000	.000	.000
Performance	.121	.217	.362	.099
Standardized Indirect Effects (Group number 1 - Default model)				
	Adoption	Information	Partnership	Integration
Information	.000	.000	.000	.000
Partnership	.000	.000	.000	.000
Integration	.000	.000	.000	.000
Performance	.289	.000	.000	.000

The findings support the theoretical framework adopted. On DOI theory the stages of the innovation decision process were found that the e-procurement adoption was at implementation stage and the manufacturing firms used in the study may be categorized into early adopters. This showed that the adopter and the attributes of an innovation affected the rate of adoption. On RBV theory it was evident from the findings that resources vary across manufacturing firms resulting in sustained competitive advantage (Peteraf, 1993). This agrees with MohdSalleh, (2009) that the value of a particular's our Camay depend on the presence of other related resources.

From the results, it was concluded that there was a significant mediation effect of the adoption of e-procurement on the supply chain performance via supply chain management practices. The supply chain performance in manufacturing firms in Kenya can be improved as a result of the supply chain management strategies adopted by the suppliers/ managers in order to adapt in a dynamic changing environment. This concurs with Sri nivasan*etal.*,(2002), in a survey of companies in multiple industries in the United States of America who found that the adoption nudes of e-business was influenced by the technological capabilities of the firms. The e-procurement adoption was seen as a physical capital resource according to RBV theory. The training and experience of managers and employee's in manufacturing firms are all highly relevant to managing e-procurement adoption. The TOE frame work was used as a basis for formulating theoretical framework. Since, it does not stipulate the specific factors that affect technological innovation.

Conclusion

The total indirect effect of e-procurement on supply chain performance was 0.289 while the direct effect was 0.121 and therefore the total causal effect of e-procurement adoption on supply chain performance was $(.121 + .289) = 0.410$. It therefore implies that the supply chain partnership, information sharing and integration variables herein referred to as supply chain management practices partially mediated the relationship between e-procurement adoption and supply chain performance. This implies that the success of manufacturing firms was dependent on the level of supply chain management practices.

The e-procurement adoption was found to make firm partner relationships and information sharing positively affects supply chain performance whereas integrated software improves supply chain performance. Supply chain performance positively influence partnership, information sharing and supply chain integration. The supply chain performance in

manufacturing firms was improved by the partnership relationship, information sharing and supply chain integration practices. Adoption of e-procurement coupled with supply chain management practices positively influenced supply chain performance. The supply chain management practices partially mediated the relationship between e-procurement adoption and the supply chain performance.

Recommendation of the Study

The manufacturing firms should ensure that there is improved transparency in the procurement process characterized by competitive bidding and sourcing in supply chain. Indeed they should provide information to all their suppliers on inventory levels of products, product compositions and raw materials purchased from them, always and promptly without bias and more importantly execute adequate debriefing of suppliers after every evaluation to strengthen partner relationships and supply chain integration.

The manufacturing firms should embrace sound supply chain management practices to enhance the firms' supply chain performance which consequently lead to profit maximization.

There is need to modify the system to take care of security concerns and this can enhance trust between the manufacturing firms and its suppliers as this will even make them move to a co-destiny relationship within the relationship spectrum.

References

- Bardi, T., Coyle, B., and Langley L. (2013).Unpacking the Systems Development Process: An Empirical Application of the CSF Concept in a Research Context". *The Journal of Strategic Information Systems*, Vol. 8 (No. 4.), pp. 351-71.
- Batenburg, R. (2007). E-procurement Adoption by European Firms: A Quantitative Analysis. *Journal of Purchasing & Supply Management*, 13,182-192.doi:10.1016/j.pursup.2007.09.014
- Bentler, P.M. (1990), "Comparative Fit Indexes in Structural Models," *Psychological Bulletin*, 107 (2), 238-46.
- Bentler, P.M., & Wu, E. J. C.(2002).*EQS for Windows user's guide*. Encino, CA. Multivariate Software, Inc.
- Bollen KA, Pearl J. (2012). Eight My this about Causality and Structural Equation Models. UCLA Cognitive Systems Laboratory, Technical Report(R-393).Draft Chapter for S. Morgan (ed.) *Handbook of Causal Analysis for Social Research*. New York, NY: Springer.
- Bollen, K.A. (1989). *Structural Equations with Latent Variables*. New York, NY: Wiley.
- Brook, f., Shin, D. & Shehab, J. (2002).Using E-procurement Applications to Achieve Integration: What Role does Firm Size Play? *An International Journal of Supply Chain Management* Volume 13 pg26 – 34.

- Chartered Institute of Purchasing and Supplies, (CIPS, 2011).<http://www.cips.com/> Accessed October 15, 2012
- Croom, S.& Johnson, R.(2003).E-service: Enhancing Internal Customer Service through E-procurement, *International Journal of Service Industry Management*,14(5).
- Eng, T.Y.(2004).The Role of E-marketplaces in Supply Chain Management, *Industrial Marketing Management*,33(2).
- European Commission (2012). Commission Staff Working Document Annual Public Procurement Implementation Review 2012.Brussels, 9.10.2012 SWD (2012) 342 final.
- Franked, J. R & Walled, N. E. (2000).*How to Design and Evaluate Research in Education*. New York, NY: McGraw hill Companies Inc.
- Giner, A. H., Alberto, A. A., Guillermo, C.R., & Cuauhtémoc, S. R. (2011). Improving E-Procurement in Supply Chain Through Web Technologies: The HYDRA Approach, *Supply Chain Management - New Perspectives*, Prof. Sand a Renko (Ed.), ISBN: 978-953-307- 633
- Greg or, S.(2006).The nature of theory in information systems. *MIS Quarterly*, 30(3), 611-642.
- Greunen, D. V., Horseman, M.E.& Niekerk, J.V. (2010) Implementation of Regulation- Based E-procurement in the Eastern Cape provincial administration. *African Journal of Business Management Vol. 4(17)*, pp.3655-3665
- Grieger, M.(2003).Electronic Marketplaces: A Literature Review and a Call for Supply Chain Management Research, *European Journal of Operational Research*, 144(2).
- Hsu,P.,Kraemer,K.L.,&Dunkle,D.(2006).Determinantsofe-businessuseinUS firms. *International Journal of Electronic Commerce*, 10(4), 9-45.
- Imai K, Keele, L, Tingly D. (2010). A General Approach to Casual Mediation Analysis. *Psychological Methods*; **15** (4): 309-334.
- Imbuga, M., Namusonge, G., Sakwa, M., & Iravo,(2011). Conducting Procurement Research in Eastern Africa, Agritech, *October-December 2010*, 33(4).
- Joreskog, K. and Sorbom, D. (1993), LISREL 8: *Structural Equation Modelling with the SIMPLIS Command Language*. Chicago, IL: Scientific Software International Inc.
- Kiprono, R. (2013).Challenges of E-Procurement Adoption in the Kenyan Public Sector: *A Survey of Parastatals in the Ministry of Finance*. Nairobi. Jomo Kenyatta University of Agriculture and Technology.

- Kline, R.B. (2005). *Principles and Practice of Structural Equation Modelling* (2nd Edition ed). New York: The Guilford Press.
- Kowalski J. & Tu, XM. (2007). *Modern Applied U Statistics*. New York, NY: Wiley
- Leung, W. (2007). Review on the Electronic Tendering System (ETS) of the Government of Hong Kong, *Unpublished Masters Dissertation*, University of Hong Kong.
- MacLean, S. and Gray, K. (2001) Structural equation modelling in market research, *Journal of the Australian Market Research Society*, 1998, Retrieved September 26, 2014, from World Wide Web: <http://www.smallwaters.com/whitepapers/marketing>
- Maxwell, J., & Mittapalli, K. (2008). Explanatory Research. In Lisa M. Given (Ed.), *The Sage Encyclopaedia of Qualitative Research Methods*. (pp. 324-326). Thousand Oaks, CA: SAGE Publications.
- Mburu, D. K. (2011). *The Role of E-Procurement in Enhancing Efficiency in Telecommunication Industry*. (A Case Study of Safari com Limited Company-Kenya). Jomo Kenyatta University of Agriculture and Technology.
- MohdSalleh,N.A.(2009).Firm's capabilities as critical determinants of adoption and utilisation of information systems by small-and medium-sized enterprises. *Asia Pacific Management Review*, 14(4), 477-498.
- Mrisho, G., (2010). *E-Procurement: Targets, Myths, Legends and Reality*, IPF. Retrieved: 1 October 2003.
- Njoroge, K.K.(2010). *Factors Influencing E-Procurement Practices in Construction Industry in Kenya*. Nairobi. Jomo Kenyatta University of Agriculture and Technology
- Ogot, M., Nyandemo, S., Kenduiwo, J. Mokaya, J., & Iraki, W.(2009).The Long Term Policy Framework for Public Procurement in Kenya, Draft Zero in Public Procurement Oversight Authority, University of Nairobi, Kenya.
- Orori, J.M.(2011).*Factors That Influence the Introduction of E-Procurement in Retail Industry: A Survey of Retail Chain Super markets in Kenya*. Unpublished research, Jomo Kenyatta University of Agriculture and Technology.
- Peteraf,M.A.(1993).The cornerstone of competitive advantage: Are source-based view. *Strategic Management Journal*, 14, 179-191.
- Presutti, W.D. (2003). "Supply management and e-procurement: creating value added in the supply chain", *Industrial Marketing Management*, Vol. 33 No. 2, pp. 219-26.

- Priem, R.L., & Butler, J.E. (2001). Is the resource-based "view" a useful perspective for strategic management research? *The Academy of Management Review*, 26(1), 22-40.
- Public Procurement Oversight Authority (2010) *Public Procurement and Disposal General Manual*, Public Procurement Oversight Authority
- Rogers, E.M. (2003), *Diffusion of innovations*. (5th Ed.). New York, NY: Free Press.
- Sivo, S. A., Fan, X. T., Witta, E .L. and Willse, J. T. (2006). The Search for 'Optimal' Cut off Properties: Fit Index Criteria in Structural Equation Modelling, *The Journal of Experimental Education*, 74, pp. 267-289.
- Srinivasan, R., Lilien, G.L., & Rangaswamy, A. (2002). Technological opportunism and radical technology adoption: An application to e-business. *Journal of Marketing*, 66, 47-60.
- Tan, K.C., Lyman, S. B., & Wisner, J. D. (2002). Supply chain management: A strategic perspective, *International Journal of Operations & Production Management*, 22(6).
- Thai, K. V. (2009). Public Administration and Public Policy/146, *International Handbook of Public Procurement*, CRC press, New York. U.S.A.
- Transparency International. (2006). *Handbook for Curbing Corruption in Public Procurement*. Transparency International, Berlin.
- Weele, A.J.V (2005). *Purchasing and Supply Chain Management: Analysis, Strategy and Practice* (4th Edition). London: Cengage Learning.
- Yamane's Yamane, Taro. (1967) *Statistics: An Introductory Analysis*, 2nd Ed., New York: Harper and Row.
- Zhu, K., & Kraemer, K.L. (2005). Post-adoption variations in use age and value of e-business by organisations: Cross-country evidence from the retail industry. *Information Systems Research*, 16(1), 61-84.