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EXTERNAL FACTORS AND EXTENDED ENTERPRISE RESOURCE PLANNING SYSTEM USAGE OF FIRMS IN KENYA'S MANUFACTURING INDUSTRY

[1]Nancy Mogikoyo Marika, [2]Kate Litondo, [3]Muranga Njihia and [4]Gituro Wainaina

[1]PhD Candidate, Department of Business Administration, Faculty of Business and Management Sciences, University of Nairobi, Nairobi – Kenya - *nancy.marika@uonbi.ac.ke*
[2]Faculty of Business and Management Sciences, University of Nairobi, Nairobi – Kenya
[3]Dean, Faculty of Business and Management Sciences, University of Nairobi, Nairobi – Kenya
[4]Faculty of Business and Management Sciences, University of Nairobi, Nairobi – Kenya

Abstract

This research was carried out with the aim of establishing effect of the external factors on eERP system usage among manufacturing firms in Kenya. It is a global trend that Extended Enterprise Resource Planning (eERP) system integrates a business firm with its supply chain partners for better organizational firm performance. However, it is a concern that past studies have given contradicting results on what factors lead to or what determines the usage of eERP in firms. The aim of this study was to discover the external factors that contribute towards the usage of eERP system usage in the manufacturing industry in Kenya. The external factors that were investigated are infrastructure like stable electricity power, stable network and reliable internet, others include vendor support, competition, and government support and their effect on eERP system usage. The research design adopted was the descriptive cross sectional research design. The population was made up of the manufacturing firms from the various 13 manufacturing sectors in Kenya. The sampling technique used was stratified proportionate sampling whereby a sample was obtained from each of the strata of the manufacturing sector. Consequently, data was collected in 269 out of 903 manufacturing firms. The descriptive data analysis was done and inferential data analysis techniques was carried out too using logit model, probit model and linear regression model concurrently so as to test the study hypothesis. The findings indicated that, electric power, reliable network and reliable internet influence eERP system usage, whereas linear regression analysis indicated that only reliable network, and reliable internet had an influence on eERP system usage. These findings are expected to inform the government in enacting policy that ensures all firms in the manufacturing industry use eERP systems and have electricity, reliable networks and internet as they seek to drive Kenya's development and economic growth to a Growth Domestic Product (GDP) of 15 percent by 2022 in support of Kenya's big 4 agenda. The main limitation of the study was that it was a cross sectional study which was done at one specific point in time. In future, a longitudinal study could be carried out to study and document improvements in the external factors for eERP system integration in a firm's supply chain.

Keywords: *eERP system, electricity, reliable network, internet, manufacturing firm, Kenya.*

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Introduction

A firm's business environment affects its operations and decision-making freedom. It has competitors, customers, suppliers and markets that business firms obtain input from and produce goods into the environment (Costa, Ferreira, Bento, & Aparicio, 2019). The normal business environment can be divided into the internal and external environment, with each influencing business firms in different ways.

Studies have cited external environment factors as: dedicated internet connection, reliable network infrastructure, reliable electric power, government incentives, data and information security, ongoing vendor support and good vendor relationships as success factors in eERP system usage in the supply chain (Ha & Ahn, 2019). The industry environment consists of a group of firms that produce related products hence there is competition for the same resources and customers. Additionally, the environment, which companies operate in is vulnerable, unstable and ever-changing system which can determine the degree of success of an organization's strategies (Juma, 2018).

Therefore, to survive the forces in the external environment, a business firm must develop competitive strategies that reflect the changes in the environment and that can enable it to survive the forces experienced in the environment (Aloo, 2019; Mose, 2018). However, there are those external factors like government policy that businesses do not have control.

Problem of Research

Manufacturing firms come are the most well-placed organizations to provide services or goods with full knowledge of what they are engaged in through supply chain (Mustisya et al, 2020; Costa, Ferreira, Bento, & Aparicio, 2019). For the most effective integration of their operations, manufacturing firms have globally incorporated eERP system usage in their functions. However, studies have indicated that not all of them remain on the market as competitive players due to external factors (Ha & Ahn, 2019; Juma, 2018; Anderson, 2019; Al-Mashari, 2018; Kagiri & Wainaina, 2017). This study therefore set to answer the research question, what is the effect of external factors on the usage of eERP systems specifically by manufacturing firms in Kenya?

Research Objective and Hypothesis

The objective of this study was to examine the external factors that affect the usage eERP Systems in manufacturing firms in Kenya. Consequently, the field question for the study was "how do external factors affect the usage of eERP system in manufacturing firms in Kenya?" The study set up a null hypothesis H_{02}: External factors have no significant effect on eERP system usage.

Literature Review and Research Focus

Theoretical Focus

This study is anchored on the Social-Technical Systems (STS) theory which views a business firm as a diversified complex matrix consisting of both a social and also a technological subsystem (Avgerou & McGrath, 2007). STS recognizes the interaction between technical aspects and the social aspects at the workplace. How well the technical and the social systems relate will help in achieving organisation excellence and quality in peoples' work. STS theory assumes that everybody in the system has basic skills in technology (Sony & Naik, 2020).

In the context, the term 'technical' is not restricted to material technology but also encompasses business practices and processes. STS theory focuses largely on the dimensions of people and society as well as on the technological facets of the

organizational structure and the business processes (Geels & Johnson, 2018).

The main criticism of STS theory is that it does not consider that there are other uncontrolled environmental forces that can affect productivity and well-being of employees. Nevertheless, this theory is key in explaining the relationship between eERP system usage and strategic collaborations as it proposes how to make systems more acceptable to end users.

Empirical Review

The link between external environmental factors and eERP systems usage is broadly documented in many studies. Competition is increasingly shaping the operations of many business entities owing to today's domestic and global competition. Customers are very much aware of the level of product and service quality they want (Ombati, 2018). This has led to use of eERP systems to efficiently manage business processes.

Nwankpa (2019) published an article based on research of various industries that they had evaluated the factors that influenced ERP systems' usage and user satisfaction through an online survey and research findings were commensurate to the findings exhibited by Carl and Labuschagne (2019). Their study demonstrated that competition, vendor support, government policies, information technology, support infrastructure budgetary allocations, user satisfaction, top management support etc are vital factors in ERPs usage. Similarly, a recent study by Costa et al. (2019) pioneered the research on finding the key reasons affecting ERP user satisfaction and adoption, and their findings were comparable with Lin (2019), which demonstrated that internal factors like top management support; external organizational factors: competition and supporting infrastructure (for example power, internet and network), government policies have a

considerable repercussion on ERP system usage.

Elsewhere, Sternard, Gradisar and Bobek (2020) undertook a study to examine the effect of exterior factors on routine ERP usage and found that extended external factors that had been observed had an effect on ERP effectiveness and usability of the ERP systems. Similarly, they also have a strong effect on attitudes concerning ERP system usage. Equally, it is evident based on several studies that most eERP systems thrive well in supply chain systems that are characterized by adequate infrastructure and information technology maturity (Anderson, 2019; Al-Mashari, 2018).

Similarly, the availability of technological infrastructure has been found to incentivize business organizations to adopt appropriate technologies. The technological support infrastructure necessary for eERP usage are network infrastructure, reliable internet connection and availability of electricity (Aloo, 2019). Good relationships with vendors and ongoing vendor support have been cited as being success factors in eERP system usage (Haaron, 2019; Mose, 2018). Conclusively, Aloo (2019) classifies technological support infrastructure such as electricity, internet connectivity, vendor support, government regulations and competitors' views as external environment determinants of eERP system usage.

Kagiri and Wainaina, (2017) found out that government power projects in developing countries were affected by factors such as unrealistic budgets, inadequate contractor experience and delays in procurement of materials; this can be a hindrance to eERP system usage as power is a key component in eERP operations thereby posing as a challenge in developing countries such as Kenya. Therefore, the proposition here is that external environmental factors such as

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government support, electricity, stable computer network, reliable internet, vendor support and industry competition influence eERP system usage.

Methodology of Research

The research paradigm employed by the researcher in this study was positivism which followed the scientific process of creating hypothesis before making declaration towards accepting or rejecting of the hypothesis (Shapiro, 2017). The main reason for the study to adopt the positivist philosophy was based on the assumption that the study set to empirically and objectively analyze the relationships existing among the variables under study as drawn from the literature review.

Sample of Research

Sampling was done using sampling size determination criteria proposed by Krejcie and Morgan (1970). At a 95 percent confidence level, a population of 903 firms could best be represented by a sample of approximately 269 manufacturing companies as shown in Table 1 below. Through the collection tool, a semi-structured questionnaire, the researcher drew up relevant conclusions and recommendations which would later be inferred to other manufacturers in Kenya. The categorization of manufacturing firm sector is presented in Table 1. Additionally, Table 1 shows how the sample size was determined from the population.

Table 1   Sample Size Determination

Sectors	Total	Sample Size	Percent
Food and Beverages	234	70	26
Metals and Allied	96	29	11
Plastic and Rubber	90	27	10
Chemicals and Allied	90	27	10
Paper and Board	82	24	9
Textiles and Apparels	73	22	8
Motor vehicles and Accessories	59	18	7
Energy, Electrical and Electronics	58	17	6
Building, Mining and Construction	39	12	4
Pharmaceutical and Medical Equipment	30	9	3
Timber, Wood and Furniture	30	9	3
Fresh Produce	13	4	1
Leather and Footwear	9	3	1
Total	903	269	100

Instrument and Procedures

The research objectives. The questionnaire had both closed ended and open questions to allow for structured and in-depth responses. The questionnaire was administered using drop and pick method. The researcher targeted heads of information technology department and heads of operations or supply chain department as respondents.

Pilot Study for Reliability and Validity

A pilot study was done on 27 manufacturing companies which were then excluded from

the final study so as to ensure the suitability of the research instruments in the study. The various measures of the variables were evaluated for reliability by assessing their values of internal consistency of their constructs using Cronbach's alpha. The overall value was 0.88 as presented in Table 2 below. All the scale items were beyond the acceptable threshold of 0.7 and were therefore retained for subsequent analysis. Table 2 below displays the reliability tests of the study variables.

Table 2   Reliability Tests

Variable	Alpha Co-efficient	Number of Items	Decision
External environment	0.91	27	Reliable
eERP system usage	0.87	27	Reliable
Average	0.88	27	Reliable

Data Analysis

The statistical analysis conducted were descriptive statistics and inferential statistics with hypothesis tested using logit, probit and linear regression models.

Results of Research

In this study, probit, logit and correlation analysis were conducted to establish the extent to which independent variables influence the dependent variable of various manufacturing firms. These techniques have been used by other scholars where the dependent variable is categorical

Descriptive of the Study Construct

External factors were tested as instrumental variables to eERP system usage. Findings as indicated in Table 3 shows a composite mean value of 3.74 and the standard deviation value of 1.156 meaning that majority of the study interviewees agreed that the various

indicators of external factors are significant in communicating the usage of eERP systems in Kenya's manufacturing industry. The reliability test (Cronbach alpha) for all the seven items in relation to external factors was 0.91 indicating a high rate of reliability.

Majority of the business firms in Kenya's manufacturing industry have a stable network connectivity (mean =3.93, standard deviation=1.216); have vendor support for systems (mean =3.81, standard deviation=0.982); are considered technological leaders (mean =3.77, standard deviation=1.078); have stable internet connectivity (mean =3.72, standard deviation=1.312). The skewness in the percentage scores and the frequencies of the respondents is towards the right, indicating that there is a positive association between the external factor indicators and the usage of the eERP system as displayed in Table 3.

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Table 3   Descriptive Statistics on External Factors (Percent)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Standard Deviation
Has reliable electric power	3.4	24	7.7	37.3	27.5	3.61	1.216
Has stable network connectivity	6	9	14.2	27.5	43.3	3.93	1.216
Has stable internet connectivity	7.7	12	21.5	18.5	40.3	3.72	1.312
Enjoys government incentives such as tax relief	9.4	12.9	19.7	33	24.9	3.51	1.256
Is considered a technological leader	4.3	9.9	16.7	42.9	26.2	3.77	1.078
Has vendor support for systems	4.7	7.3	9	60.1	18.9	3.81	0.982
Faces stiff competition	9	6.9	18	43.3	27.9	3.85	1.031
Composite score						3.74	1.156

The respondents highly affirmed with feedback of 96.6 percent as presented in Table 4 show that (225) that external factors had an overall effect the usage of the eERP system. A number of scholars across the globe have rated the influence of external factors on eERP usage above 80 percent in any given score. Ha and Ahn (2019) rated it at 87 percent influence rate, Ali and Hajj (2019) rated it at 89 percent influence level, Aloo (2019) found 91 percent rating.

Table 4   Overall Effects of External Factors

Influence of External Factors	Frequency	Percent
Yes	225	96.6
No	8	3.4
Total	233	100

Logit, Probit and Regression Analysis

The suitability of the study model (logit) was tested through goodness of fit whereby results of the log likelihood of 2.455 was obtained indicating the logit model was fit to predict the association of external factors and eERP system usage. A BIC value was 15.812 meaning that other factors held constant, external factors are responsible for 15.812 change in eERP system usage in firms in Kenya's manufacturing industry. This implied that the model can be used to predict

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the relationship between external factors and eERP system usage. The Omnibus test[a] outlined in Table 5 below indicated that the chi-square was 17.72 which was greater than 3.841, the critical value at one degree of freedom; and the (p (0.018) < 0.05), meaning

that external factors had a significant influence on the eERP system usage, hence null hypothesis was rejected. Table 5 below presents the results obtained after testing the hypothesis using logit model.

Table 5   Logit Model on Effect of External Factors on Extended Enterprise Resource Planning System Usage

(a)Goodness of Fit[a]				
	Value	df	Value/df	
Deviance	0.00	0		
Scaled Deviance	0.00	0		
Pearson Chi-Square	0.00	0		
Scaled Pearson Chi-Square	0.00	0		
Log Likelihood[b]	2.455			
Akaike's Information Criterion (AIC)	8.910			
Finite Sample Corrected AIC (AICC)	8.962			
Bayesian Information Criterion (BIC)	15.812			
Consistent AIC (CAIC)	17.812			
(b) Omnibus Test[a]				
Likelihood Ratio Chi-Square	Df		Sig.	
17.72	1		.018	
(c) Tests of Model Effects		Type III		
		Likelihood Ratio Chi-Square	Df	Sig.
(Intercept)	B	3.306	1	.069
Electric power	0.436	29.829	4	.000
Reliable network	0.060	14.537	4	.006
Reliable internet	0.381	22.110	4	.000
Government incentives	0.010	6.091	4	.192
Vendor support	0.198	8.176	4	.085
Competition	0.060	2.272	4	.686

a. Criterion Variable: eERP System Usage

b. Predictor Variables: (Constant), External Factors

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Outcomes in Table 5 above section (c) indicate that electricity had a p-value of 0.000 which was less than 0.05, reliable network has a p-value of 0.006 which was less than 0.05, and reliable internet had p-value 0.000 < 0.05) proving electricity, reliable network and reliable internet are significant indicators of eERP system usage and their chi-square values were greater than the critical value 9.49 at four degrees of freedom; therefore, electricity, reliable internet and reliable network were significant external factors to eERP system usage The resulting predictive equation from the logit tests was eERP System Usage = 0.436EP + 0.060RN + 0.381RI, where eERP was eERP system usage, EP is electrical power, RN is reliable network, and RI reliable internet. A firm having electricity increased the probability of using eERP by 43.6%, reliable network increased the probability by 6% while those with reliable internet increased the probability by 38.1%. To confirm the results of the logit test, a probit test was carried out and the results are as indicated in Table 6.

Table 6   Probit Model on Effect of External on Extended Enterprise Resource Planning System Usage

(a)Goodness of Fit[a]			
	Value	df	Value/df
Deviance	0.00	0	
Scaled Deviance	0.00	0	
Pearson Chi-Square	0.00	0	
Scaled Pearson Chi-Square	0.00	0	
Log Likelihood[b]	2.455		
Akaike's Information Criterion (AIC)	8.910		
Finite Sample Corrected AIC (AICC)	8.962		
Bayesian Information Criterion (BIC)	15.812		
Consistent AIC (CAIC)	17.812		
(b) Omnibus Test[a]			
Likelihood Ratio Chi-Square	df	Sig.	
17.72	1	.018	
(c) Tests of Model Effects			
		Likelihood Ratio Chi-Square	df	Sig.
(Intercept)	B	3.424	1	.064
Electric power	0.250	29.631	4	.000
Reliable network	0.038	13.812	4	.008

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Reliable internet	0.235	23.693	4	.000
Government incentives	0.011	5.365	4	.252
Vendor support	0.122	8.923	4	.063
Competition	0.026	2.802	4	.592

a. Criterion Variable: eERP System Usage

b. Predictor Variables: (Constant), External Factors

Probit test results shows a log likelihood of 2.455, which shows goodness of the model in predicting the variable relationships. The BIC was 15.812 shows that other factors held constant, external factors were responsible for 15.812 positive change in eERP system usage. This implied that the model can be used to predict the relationship between the external factors and eERP system usage. The Omnibus test[a] outlined in Table 6 above section (b) below indicates the chi-square was 17.72, which was greater than 3.841, the critical value at one degree of freedom; and the (p-value (0.018) < 0.05), meaning that external factors had a significant influence on eERP system usage, hence the null hypothesis was rejected.

The significant external factors indicators highlighted in the model were electricity with (p-value (0.000) < 0.05), reliable network (p-value (0.008) < 0.05) and reliable internet (p-value (0.000) < 0.05). The rest of the factors had an insignificant effect on eERP usage. The results of both the logit and probit tests for hypothesis (H_{02}), are similar. The resulting predictive equation from the probit tests was eERP System Usage = 0.250EP + 0.038RN + 0.235RI. A firm having electricity increased the probability of using eERP by 25%, reliable network increased the probability by 3.8% while those with reliable internet increased the probability by 23.5%.

A linear regression of external factors on eERP system usage was done and the model summary results are shown in Table 7.

Table 7   Linear Regression Analysis of External Factors and Extended Enterprise Resource Planning System Usage

(a) Model Summary						
Model	R	R Square	Adjusted R Square		Std. Error	
1	.377[a]	0.142	0.115		.430	
(b) Goodness-of-Fit ANOVA						
Model		Sum of	df	Mean Square	F	Sig.
1	Regression	6.892	7	.985	5.316	.000[b]
	Residual	41.674	225	.185		
	Total	48.567	232			
(c) Beta Coefficients						
		Unstandardized Coefficients		Standardized Coefficients		

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Model		B	Std. Error	Beta	T-value	Sig.
1	(Constant)	.462	.260		1.777	.077
	Electricity	.039	.024	.103	1.621	.106
	Reliable network	.091	.024	.2421	3.783	.000
	Reliable Internet	.082	.023	.236	3.568	.000
	Government Incentive	.028	.024	-.076	-.1.144	.254
	Technological leader	.002	.027	.005	.082	.935
	Vendor support	.003	.031	.006	.089	.929
	Competition	.028	.029	.064	.978	.329

a. Criterion Variable: eERP System Usage

b. Predictor Variables: (Constant), External Factors

Results from the linear regression indicated that the model had R-square of 0.142 thus it can be inferred that external factors explained 14.2 percent eERP system usage, other factors held constant with other variables which were not included in the model explaining the remaining in eERP system usage. On the overall significance of the model, it was significant since the p-value of 0.000 was less than 0.05. The findings implied that external factors had a significant effect on eERP system usage among the firms in Kenya's manufacturing industry. Consequently, the null hypothesis was rejected meaning that external factors had an effect on eERP system usage among the manufacturing firms in Kenya. In addition, the predictive equation was eERP System Usage = 0.091RN + 0.082RI since the p-values for these independent variables was less than 0.05.

Discussion

In relation to some specific components of external factors, many interviewees affirmed that their manufacturing firms had a stable network connectivity, had vendor support for systems; are considered technological leaders; have stable internet connectivity that have been instrumental in determining eERP system usage. In the literature reviewed, Chan et al. (2017), Al-Mashari (2018); Anderson, (2019) have similar opinions by asserting that most eERP systems thrive well in supply chain systems that are characterized by adequate infrastructure and information technology maturity. Aloo (2019) outlined the technological support infrastructure necessary for eERP usage to include network infrastructure, reliable internet and availability of electricity. Similarly, Mose (2018) and Aloo (2019) concluded that good relationships with vendors and ongoing vendor support have been cited as being success factors in eERP system usage.

Ha & Ahn (2019) studied factors that had an effect on ERP systems usage during the post-implementation stage focused on the external factors as among the core factors. In Romania manufacturing industry, Ali and Hajj (2019) found out that eERP performance is tied to external factors besides other determinants. Aloo (2019) used external factors like technology support infrastructure and government regulations and industry characteristics and market structure, to study the external task environment that influences ERP performance among the various manufacturing firms in Kenya. Abdel (2018) also emphasised on five external factors influencing eERP system usage including: electric power, network infrastructure,

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government policies (incentives and relief) and technology infrastructure.

This study also indicated that 40 percent had integrated their eERP system with the various supply chain partners. Similarly, Adhiambo (2018) found about 43 percent of the studied firms had partially integrated eERP with the supply chain partners. Middleware was confirmed to be the most preferred method used to integrate information system with supply chain partners with a rating of about 66 percent, is similar to Al-Mashari (2018) rated middleware as one of the most common method of integrating their information systems with the supply chain partners in most developing countries indicating that on overage, over two thirds of the manufacturing firms in Kenya have been transacting their business with other supply chain partners by use of eERP to gain a competitive advantage.

External factors have, therefore, an influence on eERP system usage. In agreement to these findings, Nwankpa and Roumani (2019) and Bokhari (2018) found out that among other factors influencing eERP usage are external factors. In their studies, they revealed that competition, vendor support, government policies, budgetary allocations and information technology support infrastructure are vital factors in ERPs usage. Elsewhere, Shatat et al. (2020) did a study to determine effect of external factors on ERP system usage. The study showed that external factors have important influence on how users perceive ERP usefulness and ERP ease of use. These findings are in tandem with the institutional theory which suggests that coercive and mimitic isomorphic forces drive changes in organisation. The proposition here is that external environmental factors such as government support, electricity, computer networks, internet, vendor support and industry competition influence eERP system usage

Conclusion and Recommendations

The study concluded that external environment contributes a significant portion to eERP system usage. The availability of reliable electric power, network and internet connectivity and reliability, the base of technology control in the industry and the cost effectiveness and stability of the internet influences eERP system usage significantly.

External factors were found to be instrumental to eERP system usage hence the research recommends that the external environment factors that should be placed at the center stage of any activity that is aimed at improving eERP system or adopting eERP system usage. Of the external factors measured, electrical power, reliable network and reliable internet were found to facilitate eERP system usage hence they should be strengthened and continuously improved in order to achieve best eERP system usage. Consequently, this study proposes that the government needs to urgently set up policy to have all manufacturing firms with steady electricity, reliable internet and dedicated internet are determinants of eERP system usage.

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