6 Influence of Supply Chain Process Integration Capabilities on Information Technology Infrastructure of Public Universities in Kenya

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Abstract

The objective of this study was to determine the influence of Supply Chain Process Integration Capabilities (SCPIC) on information technology infrastructure of public universities in Kenya. The study was underpinned on the Resource Dependence Theory. The null hypothesis that guided the study was: SCPIC have no significant influence on information technology infrastructure of public universities in Kenya. The study employed cross-sectional survey design. The unit of analysis for the study was public universities. Primary data was collected from 31 public universities in Kenya, using structured questionnaire administered to the heads of procurement and ICT departments. A pilot study was conducted. Validity and reliability tests were done using Cronbach Alpha coefficient. To describe profiles of the universities and research variables, means, standard deviations and coefficient of variations were used. Pearson's correlation was used to examine relationships between the variables. Linear regression analysis was used to test the hypothesis. The findings of the study indicated that supply chain process integration capabilities influence information technology infrastructure of public universities in Kenya. By empirically examining the model connecting the variables, the study has contributed to building of scientific knowledge. The study has provided scholars with insights into the role of supply chain process integration capabilities as an independent variable and information technology infrastructure as a dependent variable. The study concluded that supply chain process integration capabilities enhance information technology infrastructure of public universities in Kenya. This is critical in human capital development and capacity building for achievement of The 'Big 4' Agenda in Kenya and realization of Kenya Vision 2030. Public universities should make deliberate efforts to establish strong SCPIC in order to enhance information technology infrastructure of the public universities. The research recommends replication of the study in different sectors and contexts to enhance understanding of the relationship between supply chain process integration capabilities and information technology infrastructure.

Keywords: Supply chain process integration capabilities, IT Infrastructure

Introduction

Supply Chain Process Integration Capabilities (SCPIC) as a concept is concerned with the synergy that exists between the internal functions of a firm and its external activities across its supply chain that leads to organizational performance. Mani *et al.* (2018) assert that supply chain process integration capabilities have been used over the years in the manufacturing sector to enhance their competitive advantage. According to Sáenz *et al.* (2018) on average, the percentage of global companies reporting a loss of revenue due to a supply chain failure increased from 28% in 2011 to 42% in 2013. Governments are the largest consumers in an economy; on average, the public sector spends 45% to 65% of their budgets and 13% to 17% of their GDP on procurement (IISD, 2007). Supply chain management in the public sector in Kenya is characterized by increased costs, untimely service delivery, delay in procurement of goods, works and services, poor quality goods and there is corruption and waste (Public Procurement Oversight Authority, 2016)

During the financial year 2014/2015, a number of government ministries, departments and commissions had funds incurred expenditure totaling Ksh.14, 435, 690,489 of which value for money could not be established which amounts to wastages occurred in the course of procurement (Auditor General Report, Financial Year 2014/2015). Gunasekaran et al. (2015) argue that to mitigate and eliminate the negative impacts of supply chain failures in today's constantly evolving and fierce competitive business environment, the ideal cooperation, collaboration and integration between members in a supply chain and building supply chain resilience has become the first and foremost precondition to its success. Mani et al. (2018) asserted that the Supply Chain Process Integration Capabilities have been utilized over the years in the manufacturing sector by firms to enhance their competitive advantage in their areas of operation. Previous studies posit that information technology infrastructure comprises a group of shared, tangible IT resources that enable present and future business applications (Turek, 2013).

Firms in supply chain networks become reliant on others for input such as goods and materials and management of this important relationship (Kito & New, 2015). There is no organization that can be self-reliant due to variations in uncertainty deriving from the organizational environment which is responsible for both internal and external power distributions between organizational entities and participants in the market. According to Snyder and Nicholson (2017), external power is influenced by dependency relationships that exist as a result of a lack of autonomy. Constraints that organizations face lead to dependency and uncertainty, they cannot exist without purchases of resources from external sources. As supply chain members work together closely, they often become more dependent on each other. Resource Dependency Theory is based on the premise that organizations are dependent on external resources and therefore seek to manage them to ensure success in the supply chain and also control autonomy minimizing dependence.

Thompson *et al*. (2017) call for supply chains to be wary of resource dependency because it may have grave consequences where one member of the chain takes advantage to abuse another and squeeze their margins. However, it is impossible for an organization to be entirely self-reliant and therefore resource dependence is inevitable. As supply chain partners seek to build mutual forbearance and trust, perhaps resource-sharing structures should be enacted to mitigate resource dependencies and abuse of dependent partner. Kito and New (2015) opine that the Resource Dependence Theory has high value in supply chain integration and performance management. The asymmetric interdependence that exists in these inter-firm relationships is critical to reduce environmental uncertainty for some firms. In the traditional supply un-integrated supply chain, each member tries to avoid becoming overly dependent on other members for fear of exploitation.

Statement of the Problem

Much of the research that has been conducted in supply chain has attempted to establish a link between supply chain management and firm performance. Hefu et al. (2016) investigated the impact of two different dimensions of supply chain integration on two aspects of firm performance in the emerging economy of China and that the moderating effects of market orientation on the relationship between supplies chain integration and firm performance. There is limited empirical evidence on the relationship between internal integration and external integration and there is inconsistency in the findings from previous studies (Chul-hwan, 2018). Reviewed literature indicates that there is a gap in our understanding of the interrelationships between the levels of supply chain integration. Recent research found that internal company integration improved external integration and that external integration did not support internal company integration (Chul-hwan, 2018).

Cheruiyot (2013) examined the impact of integrated supply chain on the supply chain performance in Kenya Tea Development Authority (KTDA). The study used primary data and collected data from 199 employees from purchasing and supplies sections drawn from 65 KTDA managed factories in Kenya. The findings indicated that the supply chain integration (both upstream and downstream) was positively associated with supply chain performance (raw material purchasing cost, transport cost, distribution cost, asset turnover and inventory holding cost). A study by Njagi and Ogutu (2014) indicated that there is a positive and significant correlation between supply chain integration and performance of State Corporations studied in Kenya. The study however left out universities though they are State Corporations whose performance is key in the realization of Kenya Vision 2030 objective of becoming a newly industrialized nation whose citizens are expected to enjoy a middle income economy. Supply chain management in the public sector in Kenya is characterized by increased costs, untimely service delivery, delay in procurement of goods, works and services, poor quality goods, corruption and waste. Trends across the world show a growing demand for information systems for universities. Public universities have been running manual systems and

pushing paperwork for ages (Commission for University Education, 2013). They have cumbersome working procedures that have led to low productivity occasioned by highly ineffective manual systems. Nyandiere et al. (2012) postulate that most universities have implemented one form of Computer-based Information System (CIS) or another facilitate their operations.

Reviewed studies support propositions that supply chain integration is central to superior supply chain performance. Literature suggests a linkage between supply chain process integration and supply chain performance. However, some studies examining the relationship between SCPI and supply chain performance have reported inconsistent results. Whereas prior studies have shown that manufacturing firms in Kenya have embraced supply chain management practices to enhance their competitiveness, the studies have not focused on the influence of SCPIC on information technology infrastructure of public service sectors especially public universities. The conflict in the findings and the different construct measures reported in the literature require further studies. This is part of the reason for this study which sought to answer the question: what is the influence of supply chain process integration capabilities on information technology infrastructure of public universities in Kenya.

Research Objective

To establish the influence of supply chain process integration capabilities on information technology infrastructure of public universities in Kenya

Research Hypothesis

This study was guided by the null hypothesis: Supply chain process integration capabilities have no significant influence on information technology infrastructure of public universities in Kenya.

Literature Review

Information technology in supply chain management refers to the use of inter organizational systems that are used for information sharing or processing across organizational boundaries. Several applications of internal IT systems according to Kemboi and Amuhaya (2015) are; Enterprise Resource Planning (ERP), distribution resource planning (DRP), Capacity Planning Systems (CPS), Radio frequency Identification (RFID), barcodes, and Electronic Data Interchange (EDI) platforms that are used in supply chain transactions to enhance processing and communication. These tools have enabled firms to be more proactive in the management of inventory in the supply chain. The benefits associated with applying IT in supply chain include lower

coordination costs, substantial improvements in transactional efficiencies through increased information sharing and communications capabilities, resulting in improved supply chain performance (Kemboi & Amuhaya, 2015).

According to Childerhouse *et al*. (2013), supply chain management emphasizes on long term benefits of all parties on the chain through cooperation and information sharing. Information technology increases information processing capabilities of suppliers, thereby enabling or supporting greater relationship in addition to reducing uncertainty. Information technology leads to reduced cycle time, cost of procurement and errors in the processing orders. Information technology has been applied to logistics and distribution in the areas of tracking systems in transportation, and distribution planning systems; these create better visibility of the distribution channel as well as allow better control of the logistics systems (Blome *et al.,* 2014). SCPIC was expected to have a positive relationship with information technology infrastructure. There is evidence that internal integration is a prerequisite for successful SCM (Otchere *et al*., 2013).

Collaborative network theorists such as Childerhouse *et al.* (2013) opine that supply chain management emphasizes on long term benefits of all parties on the chain through cooperation and information sharing. Information technology increases information processing capabilities of suppliers, thereby enabling or supporting greater relationship in addition to reducing uncertainty. Information technology leads to reduced cycle time, cost of procurement and errors in the processing orders. Tiwari et al. (2015) affirm that information technology infrastructure capability offers the appropriate support for process by providing the reach and connectivity to design and manage processes that connect the firm with its customers' suppliers. The following conceptual hypothesis was therefore proposed; Supply chain process integration capabilities have significant influence on information technology infrastructure in public universities in Kenya.

Methodology

The study adopted a descriptive cross-sectional survey research design. A cross-sectional survey design entails collection of data across many research units at one point in time predominantly by questionnaire (Gujarati et al., 2013). The survey design was appropriate because of the purpose of the study, topical scope, and study involvement, time period over which data was collected, nature of data collected and the type of analysis to be performed. The design also has enough provision for protection of bias and maximized reliability (Kothari & Gaurav, 2014).

A target population is any group of individuals or subjects who have one or more characteristics in common that are of interest to a study (Sekaran & Bougie, 2016). The targeted respondents comprised all heads of procurement and ICT from the 31 public universities. The study population thus comprises all the 31 public universities in Kenya. The heads of procurement and ICT were targeted since they are the ones involved in the execution of key supply chain management and information technology decisions and

hence have technical knowledge on how supply chain interact with information technology and how they can be deployed to achieve superior performance. Public universities were of interest to the study since they are public entities and therefore subject to public procurement law. The study adopted a census technique with respect to the unit of analysis which were public universities in Kenya. The researcher used a census since the population of 62 was considered adequate for a census and the study aimed to reach all the procurement and ICT heads in all the 31 public universities.

Questionnaires have the advantage of obtaining data more efficiently in terms of time, energy and costs (Sekaran & Bougie, 2016). Questionnaire was used for data collection. The researcher obtained an introduction letter from the Technical University of Kenya and a research permit from the National Commission for Science, Technology and Innovation (NACOSTI). Data for the research study was collected between September 2017 and September 2018. Permission to collect data was also sought from the administrations of the 31 public universities. This was followed by recruitment of research assistants. The researcher and the research assistants used drop and pick method in the data collection. The respondents were given a maximum of a week after which the questionnaires were collected. A total of 50 completed questionnaires were collected and analyzed using simple linear regression.

Results

The study sought to establish the influence of Supply Chain Process Integration Capabilities on information technology infrastructure of public universities in Kenya. The hypothesis of the study was: Supply chain process integration capabilities have no significant influence on information technology infrastructure of public universities in Kenya. The hypothesis was tested through simple linear regression analysis. The results the results as presented in Table 1 show a significant relationship between supply chain process integration capabilities (independent variable) and information technology infrastructure (dependent variable).

Table 1

Regression Results of Supply Chain Process Integration Capabilities and Information Technology Infrastructure

a) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Supply chain process integration capabilities	.572[a]	.327	.313	.49581

b) ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
Supply chain process integration capabilities	Regression	5.731	1	5.731	23.315	.000[b]
	Residual	11.800	48	.246		
	Total	17.531	49			

c) Combined coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.844	.421		4.381	.000
Supply chain process integration capabilities	.553	.114	.572	4.829	.000

a) Dependent Variable: Information technology infrastructure
b) Predictors: (Constant), Supply chain process integration capabilities

The results in Table 1 show R= .572 and a beta co-efficient of .553 implying that there exists a positive and moderate relationship between supply chain process integration capabilities and information technology infrastructure. Coefficient of determination R^2=.327 which indicates that supply chain process integration capabilities influence information technology infrastructure by 32.7%. The relationship between supply chain process integration capabilities and information technology infrastructure is statistically significant since p-value<0.05 (P=.000) at 95% confidence level. The F value is 23.315 which is higher than the p-value depicting significant model.

Results of the coefficients show that a unit increases in supply chain integration capabilities will cause a .553 increase in information technology infrastructure. This implies that as public universities enhance their supply chain process integration

capabilities, they increase their ability to put in place IT infrastructure according to the data. The findings, thus, were sufficient to support the influence of supply chain process integration capabilities on information technology infrastructure in public universities in Kenya. Therefore, the null hypothesis**:** Supply chain process integration capabilities have no significant influence on information technology infrastructure in public universities in Kenya was not supported. The alternate hypothesis**:** Supply chain process integration capabilities have a significant influence on information technology infrastructure in public universities in Kenya was supported.

The Resource Dependency Theory had long postulated that organizations depend on internal and external resources (Kito & New, 2015). The finding of this study is consistent with previous studies. A study by Han et al. (2017) concluded that high level of IT infrastructure capability enables faster and more responsive redesign and reconfiguration of processes in responses to changes in business conditions. The results of this current study confirm the argument from previous studies of Ravichandran (2018) who argued that capability building processes and actions in IT infrastructure capabilities are important. The findings also concur with the study by Kemboi and Amuhaya (2015) who content that information technology used in managing purchasing in the supply chain is widely utilized in a variety of procurement applications including communication with vendors, checking vendor price quotes, international sourcing over internet and negotiations. Childerhouse et al. (2013) argue that information technology increases information processing capabilities of suppliers, thereby enabling or supporting greater relationship in addition to reducing uncertainty. Therefore, better IT infrastructure capabilities enable firms to position their IT assets and data and information services to capture information about customers as well as disseminate information to customers through the internet, virtual communities and personalized information channels.

Conclusion

The study concluded that SCPIC enhance information technology infrastructure of public universities in Kenya. This is critical in human capital development and capacity building for achievement of The ‘Big 4’ Agenda in Kenya and realization of Kenya Vision 2030.

Recommendations

Public universities should make deliberate efforts to establish strong SCPIC in order to enhance information technology infrastructure of the public universities. The research recommends replication of the study in different sectors and contexts to enhance understanding of the relationship between SCPIC and information technology infrastructure.

References

Blome, C., Paulrah, A., & Schuetz, K. (2014). Supply chain collaboration and sustainability: a profile deviation analysis. *International Journal of Operations and Production Management, 35*(5), 639-663.

Cheruiyot, K. (2013). Impact of integrated supply chain on performance at Kenya Tea Development Agency. *International Journal of Social Sciences and Entrepreneurship, 1*(5), 194-203.

Childerhouse P., Luo W., Basnet C., Ahn H. J., Lee H., & Vossen. G. (2013). Evolution of inter -firm relationships: A Study of supplier logistical services provider customer triads. *International Journal of Industrial Engineering, 20*(1-2), 126–140.

Chul-hwan Han (2018). Assessing the impacts of port supply chain integration on port performance. The *Asian Journal of Shipping and Logistics, 34*(2), 129-135.

Commission for University Education (CUE). (2013). Status of universities in Kenya. Available at: http://www.cue.or.ke/services/accreditation/status-of-universities.

Gujarati. D., Porter. D., & Gunasekar, S (2013). *Basic Econometrics*, 5th Ed, New Delhi, Tata McGrawHill Education Private Limited.

Gunasekaran. A., Subramanian. N., & Rahman, S. (2015). Supply chain resilience: role of complexities and strategies. *International Journal of Production Research, 53*(22), 6809-6819.

Hefu. L., Ke. W., Wei. K, K., & Hua. Z. (2016), Effects of supply chain integration and market orientation on firm performance: Evidence from China, *International Journal of Operations and Production Management*, *33*(3), 322346.

Kemboi, M. K., & Amuhaya, M. I. (2015). Access factors affecting supply chain efficiency of medical supplies in public health centres in Kenya: A Case study of public health centres in Elgeyo Marakwet County: *International Journal of Academic Research in Accounting, Finance and Management Sciences, 5*(2), 32–41.

Kito, T., & New, S. (2015). Towards capturing heterogeneity of supply network structures and their temporal transitions: an investigation of supply relationships in the Japanese automobile industry. *Evolutionary and Institutional Economics Review, 12*, (2), 333–347.

Kothari.C. R., & Gaurav, G. (2014). *Research methodology: Methods and techniques* (3rd Ed), New Delhi, New Age International (P) ltd Publishers.

Mani, V., Gunasekaran, A., & Delgado, C. (2018). Enhancing supply chain performance through supplier social sustainability: An emerging economy perspective, *International Journal of Production Economics, 195,*259–272, www.elsevier.com/locate/ijpe.

Njagi, M., & Ogutu, M. (2014). Role of supply chain integration on supply chain performance in Kenyan state corporations. *International Journal of Current Business and Social Sciences, 1*(2), 188-204.

Nyandiere, C., Kamuzora, F., Lukandu, I. A., & Omwenga, V. (2012). Implementing enterprise systems for management. A Case of Kenyan Universities: *Computer Technology and Application,* 3, 558-563.

Otchere, A.F., Annan, J. & Anin, E.K. (2013). Achieving competitive advantage through supply chain integration in the cocoa industry: A case study of Olam Ghana Limited and Produce Buying Company Limited. *International Journal of Business and Social Research (IJBSR), 3*(2), 131-145.

Ravichandran T. (2018). Exploring the relationships between IT competence, innovation capacity and organizational agility, *Journal of Strategic Information Systems, 27*(2), 22–42.

Report of the Auditor-General on the financial statements for national government of Kenya for the Year 2017/2018.

Public Procurement Oversight Authority, (2016). *Public procurement and disposal general manual.* Nairobi: Public Procurement Oversight Authority.

Sáenz, M. J., & Revilla, E., & Acero, B. (2018). "Aligning supply chain design for boosting resilience," *Business Horizons,* Elsevier, *61*(3), 443-452.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill-building approach, (*7th Ed) Chichester, West Sussex, United Kingdom: John Wiley & Sons.

Snyder Christopher & Nicholson Walter. (2017), *Micro economic theory: Basic Principles and Extensions*, 12th Ed, South Western Cengage Learning, Canada .social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173–1182.

Thompson, P., Williams, R., & Kwong, C. (2017). Factors holding back small third sector organizations' engagement with the local public sector, *Nonprofit Management and Leadership*, 27(4), 513-531.

Tiwari, A.K., Tiwari, A., & Samuel, C. (2015). Supply chain flexibility: a comprehensive review. Management Research Review 38 (7), 767–792.

Turek, B. (2013). *Information systems in supply chain integration and management.* Retrieved from http://www.ehow.com/ info_8337099_information-supply-chain-integration-management.html.