INFLUENCE OF INFORMATION TECHNOLOGY INFRASTRUCTURE AND GOVERNMENT POLICY ON THE RELATIONSHIP BETWEEN SUPPLY CHAIN PROCESS INTEGRATION CAPABILITIES AND SUPPLY CHAIN PERFORMANCE OF PUBLIC UNIVERSITIES IN KENYA

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A Thesis Submitted in Fulfillment of the Requirements for the Award of the Degree of Doctor of Philosophy in Business Administration (Procurement and Supply Chain Management), School of Business and Management Studies,

Technical University of Kenya

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DECLARATION

I declare that this PhD thesis is my original work, and as far as I am aware, it has not been presented for the award of a degree in any other university.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANCOVA	**:**	Analysis of Covariance
ANOVA	**:**	Analysis of Variance
APS	**:**	Advanced Planning Systems
CFA	**:**	Confirmatory Factor Analysis
CI	**:**	Customer Integration
CIS	**:**	Computer-based Information System
CNT	**:**	Collaborative Network Theory
CSCMP	**:**	Council of supply chain management professionals
CPFR	**:**	Collaborative Planning, Forecasting, and Replenishment
CRM	**:**	Customer Relationship Management
CUE	**:**	Commission for University Education
ECR	**:**	Efficient Consumer Response
EDI	**:**	Electronic Data Interchange
ERP	**:**	Enterprise Resource Planning
GoK	**:**	Government of Kenya
GDP	**:**	Gross Domestic Product
GPA	**:**	Government Procurement Agreements
FOSS	**:**	Free and Open Source Software
ICT	**:**	Information and Communications Technology
IFMIS	**:**	Integrated Financial Management Information System
IT	**:**	Information Technology
JIT	**:**	Just-in-Time
JITD	**:**	Just-in-Time Distribution
KTDA	**:**	Kenya Tea Development Authority
KI	**:**	Kaiser Criterion
MIS	**:**	Management Information Systems
MNCs	**:**	Multinational Companies
NACOSTI	**:**	National Commission for Science, Technology and Innovation
OTIF	**:**	On-Time In-Full
PE	**:**	Procuring Entities

PCA	**:**	Principal Component Analysis
PMS	**:**	Performance Measurement Systems
P2P	**:**	Procure to Pay
PPAD	**:**	Public Procurement and Assets Disposal
PPPs	**:**	Public Private Partnerships
PPOA	**:**	Public Procurement Oversight Authority
PPAB	**:**	Public Procurement Advisory Board
PPAR	**:**	Public Procurement Administrative and Review Board
PPDA	**:**	Public Procurement Disposal Act
PPDR	**:**	Public Procurement Disposal Regulations
PWHC	**:**	Price Water House Coopers
RFID	**:**	Radio Frequency Identification
RBV	**:**	Resource Based View
RDT	**:**	Resource Dependence Theory
SCI	**:**	Supply Chain Integration
SCM	**:**	Supply Chain Management
SCPIC	**:**	Supply Chain Process Integration Capabilities
SD	**:**	System Dynamics
SI	**:**	Supplier Integration
SPSS	**:**	Statistical package for social sciences
STI	**:**	Science, Technology and Innovation
VIF	**:**	Variance Inflation Factors
VMI	**:**	Vendor Managed Inventory
VRIN	**:**	Valuable, Rare, Inimitable and Non-substitutable
WB	**:**	World Bank
WTO	**:**	World Trade Organization
ZRESID	**:**	Standardized Residuals
ZPRED	**:**	Standardized Predicted

DEFINITION OF OPERATIONAL TERMS

Government Policy: Refers to laws, rules and regulations that are put in place to govern the process of public procurement and assets disposal by public entities for efficient functioning. In Kenya the Public Procurement and Assets Disposal Act 2015 was enacted by Parliament to give effect to Article 227 of the Constitution of Kenya 2010. This study operationalized government policy as procurement law and procurement procedures.

Information Technology Infrastructure: constitutes the organization's enabling base of shared information technology capabilities that provide a reliable foundation for evolving business information systems and services. Information technology infrastructure refers to sets of physical information technology assets, intangible information technology skills including computer hardware, communication networks, database, business applications, and information technology human resource. Information technology infrastructure comprises a group of shared, tangible IT resources that enable present and future business applications (Turek, 2013). This study operationalized information technology infrastructure as internal infrastructure and external infrastructure.

Supply Chain Performance of Public Universities in Kenya: The ability of the public universities' supply chains to deliver the right product or service to the correct location at the appropriate time and at the lowest cost of logistics. This study operationalized supply chain performance of thirty one (31) public universities in Kenya as internal operational dimensions (time, cost leadership, product quality and productivity, and customer service dimensions (quality of service, flexibility and delivery reliability).

Supply Chain Process Integration Capabilities (SCPIC): Is the structuring of activities and processes to assist organizations develop, allocate and align resources to achieve distinctive capabilities to generate better performance and competitive advantage. This study operationalized SCPIC as information flow integration, physical flow integration and financial flow integration.

ABSTRACT

The overall aim of the study was to assess the influence of Information Technology Infrastructure (ITI) and government policy on the relationship between supply chain process integration capabilities (SCPIC) and supply chain performance of public universities in Kenya. Specific objectives of the study were: to determine the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya; establish the influence of SCPIC on ITI of public universities in Kenya; assess the influence of ITI on supply chain performance of public universities in Kenya; establish the mediating effect of ITI on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya; determine the moderating effect of government policy in the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya, and to establish the joint effect of SCPIC**,** ITI and government policy on supply chain performance of public universities in Kenya. The study was underpinned on four theories namely: Resource Based View, Collaborative Network Theory, Agency Theory and Resource Dependence Theory. This study was guided by null hypotheses: $H_{01:}$ SCPIC have no significant influence on SC performance of public universities in Kenya, $H_{02:}$ SCPIC have no significant influence on ITI in public universities in Kenya, $H_{03:}$ ITI has no significant influence on SC performance of public universities in Kenya, $H_{04:}$ ITI has no significant mediating effect on the relationship between SCPIC and SC performance of public universities in Kenya, $H_{05:}$ Government policy has no significant moderating influence on the relationship between SCPIC and performance of public universities in Kenya; $H_{06:}$The joint effect of SCPIC, ITI and GP on supply chain performance of public universities in Kenya is not different from their individual effects. The study employed cross-sectional survey design. The unit of analysis for the study was public universities. The study was a census. Primary data was collected from 31 public universities 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. To test the hypotheses, linear regression, multiple regression and hierarchical regression were used. The findings of the study indicated that information technology infrastructure mediated the relationship. Government policy moderated the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. The results demonstrated that the joint effect of SCPIC, ITI and government policy on supply chain performance was greater than the effect of individual variables on supply chain performance of public universities in Kenya. By empirically examining the integrated model interconnecting variables, the study has contributed to building of scientific and professional knowledge to policy makers in Kenya and beyond. The study has provided scholars with new insights into the role of government policy as a moderating variable and information technology infrastructure as a mediating variable in the linkage between supply chain process integration and supply chain performance. The study concluded that SCPIC, ITI and government policy enhance supply chain performance of public universities. The research recommends replication of the study in different service sectors and national contexts to enhance understanding of the relationship between SCPIC and supply chain performances.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

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, Gunasekaran & Delgado, (2018) assert that Supply Chain Process Integration Capabilities have been used over the years in the manufacturing sector to enhance their competitive advantage. Supply Chain Management (SCM) is a process that controls, coordinates, and integrates the logistics and the flow of information and capital from original suppliers through a series of intermediaries to end customers in a timely manner to improve the performance of all parties involved (Kumar & Kushwaha, 2018).

There is consensus that the SCM goal is to achieve effective and efficient flow of products, services, information, money and decisions, to provide maximum value to customer at reduced cost and high speed, occupying funds, increased market shares and sales, On-Time In-Full (OTIF) deliveries, and solid customer relations (Kumara & Rahman, 2015). Equally, Nair, Jayaram & Das, (2015) aver that this unity in purpose enables the supply chain partners to streamline their processes to eliminate duplication, improve communications and adjust their operations to achieve efficiency. Despite the growing interest among practitioners and researchers in improving firm performance through SCM, there is enough evidence to suggest that achieving SCM success may not be as effective in most cases as assumed (Marchi & Zanoni 2018).

Further, Kumar & Kushwaha (2018) established no sufficient evidence to support a significant positive relationship between SCM and firms' performance, and some researchers even found a negative relationship between SCM and performance. The failure of SCM would incur actual negative impacts on the operational continuity and sometimes even threaten the very survival of the firms involved in the supply chain. According to Sáenz, Revilla & Acero (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. During the financial year 2014/2015, a number of government ministries, department 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, Subramanian & Rahman (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.

The Collaborative Network theorists argue that the value of the resources can be expanded by its combination with other resources, then building effective inter-firm relationships within the network or supply chain can be more important than resource possessions per se (Festel, De Nardo & Simmen, 2014). The study of supply chain management began in the early 1980s, where most of the literature was coiled from strategic management that was premised on firm's competitiveness that includes resources and capabilities (Quynh & Huy, 2018). This perspective labeled as the Resource Based View (RBV) of the firm holds that development and deployment of resources and capabilities to enhance effectiveness and efficiency in exploiting environmental opportunities determines the firm's level of performance. Since the 1990s, the RBV became more focused on intangible resources, particularly knowledge, because it is unique and difficult to imitate, as a source of sustainable competitive advantage (Fathi & Ahmadian, 2016). This theory affirms that its attainment is contingent to the congruency or fit among key organizational variables such as process integration and information technology infrastructure that are critical in obtaining prime performance.

This study was grounded on Resource Based View (RBV), Resource Dependence Theory (RDT), Collaborative Network Theory (CNT) and Agency Theory. This study hypothesized that creation and utilization of supply chain process integrative capabilities and resources to respond to dynamisms in the turbulent environment determines the level of supply chain performance (Kamasak, 2017). Resource Dependence Theory postulates that 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. Equally Resource combination results in better outcomes than those achieved by a single firm acting alone. CNT argues that an effective relationship among supply chain partners can help facilitate a combination of the resources owned by the firms. The establishing of information sharing and collaborative communication among firms can build the relationships with their supply partners through the social exchange process to improve their performance. On the other hand for successful collaboration to exist among supply chain partners there is need for other players to support this process, which calls for principal-agency relationship. The Agency Theory is concerned about the relationship between the principal and the agent. When two parties are involved in an agency relationship they cooperate and participate in an association wherein one party (the principal) delegates decisions and/or work to another (an agent) to act on its behalf (Panda & Leepsa, 2017).

In Germany Khalid et al. (2012) found that technological integration emerges as the core supply chain management practice frequently identified and is contingent with a number of other practices. Further, supply chain management practices including long-term relationship development, partner development, joint development, enhanced communication, learning, stakeholder management and innovation have regularly been referred to and are considered important in improving the performance of public institutions.

In China, Lin (2014) argued that although the agricultural sector was regarded as a mature sector, there remained significant inefficiencies in on-farm resource management that presented opportunities for environmental improvements through supply chain management practices like collaboration, adoption of information technology and enhancement of farm-supplier relationships.

Kenyan public universities operate under the Public Universities Act (2012) and are hence subject to the public legislation and procedures that they have to adhere to (GoK, 2016). Trends across the world show a growing demand for information systems for universities. Public universities have been running manual systems, pushing paperwork, for ages. They have had cumbersome working procedures and this has led to low productivity occasioned by highly inefficient manual systems. Most of the universities have implemented one form of Computer-based Information System (CIS) or other to manage their academic and management needs and to facilitate and enhance institutional management given their abilities to standardize, streamline operations, and integrate processes in their operations (Nyandiere, Kamuzora, Lukandu & Omwenga, 2012). They include Enterprise Resource Planning (ERP) systems which are implemented to enhance efficiency and effective through integration of business processes. Enterprise resource planning is one of various software systems that are used to make the integration between the three processes. Monk and Wagner (2013) defined ERP as systems that can help a company integrate its operations by serving as a company-wide computing environment that include delivering consistent data across all business function.

Evolution and development in information technology allowed ERP to evolve and being flexible to link all supply chain parties. ERP link different applications into single application that integrates the data and business processes such as integrating the following operational functions: marketing and sales, accounting, human resources, purchasing, and logistics (Mohmood & Lloyd, 2017). Hui, He-Cheng & Min-Fei, (2015) denote that much research and academic papers have been written about supply chain management and its elements. Some investigated supply chain integration; others studied supply chain performance, while others discussed mediating factors that affect supply chain integration or performance and/or both of them. Finally, some studies have addressed both elements together that is, supply chain integration and performance.

Zhang and Huo (2012) focused on dependence and trust and its impact on external integration (supplier and customer). While some organizations are able to achieve certain components of supply chain integration, several studies have reported continued lack of supply chain process integration across both inter-organizational and intra-organizational supply chains holistically (Hall, Algiers & Levitt, 2018) and that even similar organizations have adopted different supply chain integration strategies and are in different stages of progress. Nyandiere et al., (2012) also established that Kenyan universities have no significant differences in information systems' needs, but there are very significant differences in the strengths and weaknesses among the private and public universities in the capabilities of systems they have implemented. The public universities are noted to have weaker systems that are incapable of allowing seamless flow of information within their organizations sub-units.

1.1.1. Supply Chain Process Integration Capabilities

Supply Chain Process Integration Capabilities (SCPIC) is defined as the alignment of supply chain goals and objectives between functions and enterprises and linkages of these functions and enterprises through information transparency, electronic or people to people (Antwi et al., 2015). Literature defines supply chain process integration capabilities as the degree of integration of core processes across organizational boundaries through improved communication, partnerships, alliances and cooperation. Asgari, Hamid & Aleebrahim (2017) admit that integration also includes the application of new technologies to improve information flows and coordinate the flow of physical goods between supply chain partners. Yunus & Tadisina (2016) accentuate that there is growing recognition of the supply chain and value network approaches to managing business operations. Antwi et al., (2015) call for viewing customer value creation in the context of a network of organizations rather than within the boundaries of individual firms.

When a firm develops distinctive supply chain capabilities through supply chain process integration, it is likely to achieve competitive advantage in the market and result in bigger market share. Efficiency-related capabilities focus on cost reduction, which in turn directly contributes to better financial performance. Hall, Algiers & Levitt (2018) opine that effectiveness-related capabilities such as availability, timeliness, and quality centers on customers and thus can positively impact customers' value perception. According to Asgari, Hamid & Aleebrahim (2017) customer satisfaction can also result when efficiency capabilities can be converted into lower cost for customers. Satisfying customers through value creation helps a firm's bottom line.

In practice, integration practices engaged in by firms include: Collaborative Planning, Forecasting and Replenishment (CPFR) practices, Just-In-Time Distribution (JITD) practices, Customer Relationship Management (CRM) practices, Vendor Managed Inventory (VMI) practices, and Efficient Consumer Response (ECR) practices. Similarly, firms that implement Advanced Planning Systems (APS) may integrate production decisions across the supply chain by including supplier inventory and capacity constraints into their scheduling function. Integrative practices capabilities of supply chains help to elevate the linkages within each component of the chain and can facilitate better decision making to get all the pieces of the chain to interact more efficiently. Pietrzak, Paliszkiewicz & Klepacki (2015) on the other hand observes that organizations that pursue integration can attain competitiveness in terms of added value in inventory management, yield effectiveness and efficiencies in service delivery and product quality.

A supply chain approach to managing business operations, on the one hand, advocates the alignment and integration of key business processes across the entire supply chain with particular emphasis on efficiency, responsiveness and agility. Kumara et al., (2017) equally acknowledges that many models of most manufacturing organizations in the past were vertically inclined with the focal firm fully or partially owning its raw material suppliers. Adebanjo, Teh & Ahmed (2018) depict that supply chain integration capabilities advocates for mutual information sharing, risks and rewards and mutual cooperation, as well as sharing of the same goals and focus on serving customers, while building and maintaining long term relationships with supply chain partners.

Chopra & Meindl (2016) assert that the focus to deliver superior value by the entire chain is mainly achieved by collective and coordinated efforts of all the partners in the chain. The synergies to be gained at each stage of value addition across the supply chain cannot be realized if each individual partner was to act on its own. However Adebanjo, Teh & Ahmed (2018) posit that when holistically viewed, supply chain essentially achieve robustness and agility.

1.1.2. Information Technology Infrastructure

In the recent past, researchers and practitioners have given much attention to the topic of information technology infrastructure. Information technology infrastructure is the extent to which a firm has established Information Technology (IT) capabilities for the consistent and high-velocity transfer and information sharing within and across the supply chain boundaries.

Previous studies posit that information technology infrastructure comprises a group of shared, tangible IT resources that enable present and future business applications (Turek, 2013). In today's turbulent market environments, a flexible information technology infrastructure can instantaneously deliver rapid results and support sustainable growth (Tiwari, Tiwari & Samuel, 2015). IT supports rapid data-driven innovation, knowledge-sharing, and relational coupling with supply chain partners and enables flexible processes- often considered a primary goal of IT application adoption, such as Enterprise Resource Planning (ERP) or Electronic Data Interchange (EDI). Information Communication Technology (ICT) impacts both internal process and external integration by increasing the flow of relevant information among process participants by shaping closer supplier and customer relationship.

Based on a survey of 127 companies in China, Peng, Quan, Zhang & Dubinsky (2016) also empirically confirmed that a firm's capability to manage both internal and external business processes fully mediate the impact of IT on performance.

1.1.3. Government Policy

According to Chigudu (2014) Public entities are directly influenced by governments in their supply chain decisions due to their high procurement budgets which have significant influence on the economic, environment and social objectives. Zadawa (2015) equally reiterated that public procurement represents 18.42% of the world GDP. As a result of this, various countries both in developed and least developed have instituted procurement reforms involving laws and regulations.

According to Kramer (2016) universities are charged with ensuring that not only procurement officials, but public service in its entirety is conducted in compliance with the values and principles enshrined in the procurement policy, however the major obstacle has been inadequate regulatory compliance. According to the GoK (2015), public procurement is under the regulation of the Public Procurement and Disposal Act, 2015. Sandru (2017) illustrates that the Act spells out the regulations and guidelines issued by the Public Procurement Oversight Authority (PPOA) Institutions such as Kenya National audit and Public Procurement Regulatory Authority (PPRA) foster compliance with procurement regulations. These institutions are established in terms of chapter six of the Constitution of the Republic of Kenya 2010. They are regarded as watchdogs which keep government in check and transform the society, thus safe-guarding constitutional democracy.

Institutional theorists assert that if organizations complied with the public procurement regulations then they would be assured of competition in bids, transparent processes, and professional approach in procurement process. According to Sarpong, Du, Antwi, Boamah & Adeleke (2017) implementing an efficient procurement system improves organizational performance and nationally improve policy formulation and decision makers understand the interactions of the various policy goals and the impact of the policy on overall performance of the system. Decision makers can make improved and informed decision, create stronger incentives on governments to improve their public procurement systems, help them to set priorities for reform actions in the area of public procurement and to monitor, evaluate and review public expenditure system.

1.1.4. Supply Chain Performance

Business enterprises have a drive to constantly outperform their competition and be able to sustain greater returns to the stakeholders while satisfying others. In management research one of the most commonly used construct is the organizational performance and its improvements as the overriding theme. Piotrowicz & Cuthbertson (2015) admits that performance construct enables researchers to evaluate firms over time and compare them to competitors. Suthar, Chakravarthi & Pradhan (2014) categorized performance into human resource, organizational, financial and market measures. According to Zhang & Okoroafo (2015) supply chain performance is defined as the ability of the supply chain to deliver the right product to the correct location at the appropriate time at the lowest cost of logistics. The same authors further indicate that this definition include the most important aspects of the supply chain that include delivery time, cost and value for the final consumer.

As a structure, supply chains have moved from a linear to a network and this creates the necessity to track a growing amount of information allowing the evaluation of the functioning of the entire supply chain. Gunasekaran, Subramanian & Rahman (2015) aver that the problem of assessing the performance of the supply chain is from different angles. These authors distinguish indicators according to the level of the decision-making process at the strategic, tactical, and operational levels. These indicators are also divided into cost and the non-cost, and qualitative and quantitative.

The qualitative measures are customer satisfaction, flexibility, information and material flow integration, effective risk management, and supplier performance. Montero, Schmalenberg, Quirós & Doluschitz (2018) established efficacy, effectiveness and efficiency as indicators of performance. Dametew, Ebinger & Beshah, (2018) assert that performance measurement is crucial in managing organizations in turbulent environments and competitive global markets. An appropriate set of metrics enable companies to observe their progress in implementing their strategy, identification of areas that need improvement, as well as comparing themselves with competitors and leaders. They provide the necessary information for managers so that they can take the right decisions at the right time. One of the problem associated with performance measuring is the attempt to analyze too many indicators which do not relate to the company's strategy (Cazeri, Anholona, Ordoñeza & Novaskia, 2017). Performance measurement should be performed in a particular context and the analyzed dimensions of indicators resulting from the purpose and focus of the measurement should be determined.

1.1.5. Public Universities in Kenya

Public universities in Kenya are incorporated under the Universities Act, 2012 Laws of Kenya. This Act Republic of Kenya (2012) provides for monitoring, development of public university education, governance and accreditation of universities. The universities in Kenya are regulated by the Commission for University Education (CUE) which is a sole regulatory body for universities as a successor of the Commission of Higher Education which was established in 1985 by an Act of parliament, University Act, Cap 210B (GoK, 1985) that ensured planning and coordinating the growth and expansion of the university education in Kenya. According to the Commission for University Education (CUE), 2017, Kenya has 31 accredited public universities. The public universities contribute towards the generation of broader economic growth in terms of creation of employment opportunities, creation of innovation and diversification of the income generating paradigms through research. The universities also nurture their graduates with the expectation that they can contribute towards solving challenges. The universities help in unlocking and harnessing new knowledge, building cultural and political understanding and modeling environment that promotes dialogue and debates.

Supply chain activities in the public universities continue to evolve both conceptually and organizational and in order to be more effective and efficient in managing the interests and assets of its stakeholders in a dynamic environment, the public universities have to reform. Further according to Fourie & Poggenpoel (2017), performance is a contemporary issue that applies to private, public, profit and non-profit organizations. As a result, optimization is central to attainment of any objective.

There is therefore emphasis on efficiency, transparency, accountability in the universities processes and operations in order to enhance supply chain performance. Supply chain integration enhance universities supply chain performance through streamlining the internal businesses process in the universities while at the same time linking the universities with their customers and suppliers for them to enhance good governance, promote transparency, increase accountability, and improve the efficiency of the processes while ensuring monitoring and evaluation capabilities. There are clear indications that supply chain integration would add value to the operations hence promoting high organizational performance in public universities (Singh, Sohani & Marmat, 2013).

Public universities in Kenya are operating in a competitive environment. It is important for the universities to adopt supply chain integrative practices to enhance efficiency and effectiveness. This can lead to improvement in supply chain performance and attainment of a competitive advantage in their areas of operation. In a study examining supply chain integration and competitiveness of state corporations in Kenya by Njagi & Ogutu, (2014) found that the corporations had implemented one form of Computer-based Information System (CIS). Information technology facilitates and enhances institutional management given its abilities to standardize, streamline operations, and integrate business processes (Nyandiere, Kamuzora, Lukandu & Omwenga, 2012). However, the studies did not focus on the effect of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities and supply chain performance of the public universities in Kenya.

Thus, public universities were considered a suitable context to examine the relationship between supply chain process integration capabilities and supply chain performance.

1.2 Statement of the Problem

Organizations are operating in turbulent environments and competitive global markets. The mounting level of competition that exists among firms globally has brought a shift for entities to do more than just strategy formulation and implementation, but to go beyond that and seek partnerships with other firms which would lead to competitive advantage in the market place (Kumar et al, 2017).

Over the years, both manufacturing and service firms have focused on developing strategies that would bring about the much desired level of change and operational performance in the organizations. Supply Chain Process Integration Capabilities (SCPIC) are critical in the supply chain performance of organizations. An agile supply chain process integration system should effectively address information flow integration, physical flow integration and financial flow integration. Good information flow integration should help an organization to share its proprietary information with its supply chain partners in a competitive environment. Exchange of information with partners helps in establishing of sound Enterprise Resource Planning (ERP).

When information is shared among partners in a supply chain, in a timely, adaptive and in a reliable way, business parties can be able to operate with standardized supply chain practices. This contributes towards enhancing the SCPIC position of enhancing the supply chain performance of organizations. The supply chain performance of public universities in Kenya can be manifested in terms of efficient internal operational dimensions like time, cost leadership, product quality and productivity;

and customer service dimensions like quality of service, flexibility and, delivery reliability. Information technology infrastructure through internal infrastructure and external infrastructure can also enhance intra and extra organizational transactions between the public universities in Kenya and suppliers in the supply chain. The prevailing government policy through the procurement law and procurement procedures is expected to regulate the procurement operations relating to the supply chains of the public universities in Kenya.

Though public universities in Kenya are expected to ensure that the goods and services that they require move seamlessly from the source to the user in the public universities as per the set-up of integrated systems with their suppliers, the way inventory is managed has not led real time operations in procurement. Real time operations require dynamic supplier relationship management systems that are linked to customers and other stakeholders. Progressive public universities are expected to set up superior customer relationship systems that support business decision making. This is expected to be reflected in the information technology infrastructure that organization set up to avoid stand-alone technology. Due to dynamic changes in university operations, funds are expected to flow in the public universities to facilitate operations. Public universities in Kenya have not been able to set up Tech savvy systems to operate state of the art technology integrated systems to provide e-invoicing, e-payment, and internal transfer of funds within the universities. These challenges encountered by public universities may be attributed to the type of information technology infrastructure and weak government policies in procurement.

Nyandiere, Kamuzora, Lukandu, & Omwenga (2012) aver that supply chain performance of public universities in Kenya has been adversely affected by weak internal operational and customer dimensions. This has made public universities not to build versatile and robust supply chain process integration capabilities that can help them attain a competitive advantage in their operations through agile supply chain performance. Hence the inability of public universities not fully realizing their mandates that include provision on their mandate of providing cutting edge training at the Postgraduate, Undergraduate and Diploma levels, while at the same time engaging in research, innovation, and community work. These challenges can be traced to the type of supply chain process integration capabilities that are built by the public universities, the information technology infrastructure utilized internally and externally, and the level of compliance with the government policy that regulates public procurement hence the need for the current study.

Globally public procurement is central to the delivery of public services and performance of public entities (Uyarra et al., 2014). Scholars have identified the following key problems in the public procurement system like: weak and outdated procurement policies and processes; public sector procurement remaining an operational activity and not a strategic activity; a lack of accountability and transparency; a lack of procurement knowledge and skill; embedded fraud and corruption and; the inability to implement appropriate reforms (Dzuke and Naude (2017). Despite the numerous benefits of supply chain integration most of the reviewed literature examining the relationship between supply chain process integration capabilities and Supply chain performance have yielded inconsistent results.

Further the consistency of measures and constructs is still limited as well as different aspects of integration are measured, without explicitly addressing such choices (Klimczak, Machowiak, Staniec & Shachmurove, 2017). According to Zhang & Huo (2013), much of the literature focused on the levels and components of supply chain integration. Jaiswal et al., (2018) addressed integration and measured the pattern of behavior and operational practices respectfully. Accordingly, it was established that there is a direct relationship between internal integration, business, and operational performance and that customer integration directly relates to operational performance. Although supplier integration does not relate directly to either type of performance, the integration of supplier and customer were related to operational performance and that internal and external influence each other along with performance.

Much of the research that has been conducted in supply chain has attempted to establish a link between supply chaim 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). The detailed literature review showed 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).

However, most of these studies did not specify what levels of external integration are improved in the presence of internal company integration. Zhang & Huo (2013) suggested the inconsistency of the levels and components of integration, this literature review proposed that the national and product contexts, theoretical foundation and validating data across the supply chain are also important factors that need to be considered in supply chain integration research.

Whereas some studies (Gunasekaran, Subramanian & Rahman, 2015; Klimczak, Machowiak, Staniec & Shachmurove, 2017; Zhang, M., & Huo, B. 2013) reported direct positive relationship between SCPIC and supply chain performance, other studies (Jaiswal et al., 2018) did not find a direct relationship between supply chain integration and performance.

In sub-Saharan Africa, Ringwald & Ndercaj (2014) identified common problems affecting public sector procurement: the lack of transparency, accountability and integrity in policy and process; the lack of professional, managerial and leadership skills; the lack of strategic recognition for the procurement function; the continued failure to implement appropriate change and; weak and outdated procurement policies and processes. 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. 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. During the financial year 2017/2018, a number of Ministries, Department 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 much of the wastages occurred in the course of procurement (Auditor General Report, Financial Year 2014/2015).

Cheruiyot (2013) examined the impact of integrated supply chain on the supply chain performance in 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) indcated that there is a positive and significant correlation between supply chain integration and performance of the State Corporations studied in Kenya, the study however left out universities though they are State Corporations whose performance is key in the realization of Keya Vision 2030 objective of becoming a newly industrialized nation whose citizen 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 and there is corruption and waste. Trends across the world show a growing demand for information systems for universities. Public universities have been running manual systems, pushing paperwork, for ages. They have had cumbersome working procedures and this has led to low productivity occasioned by highly incompetent manual systems. Nyandiere, Kamuzora, Lukandu, & Omwenga (2012) postulate that most of the

universities have implemented one form of computer-based information system (CIS) or other to facilitate their operations.

Kenyan public universities operate under the Public Universities Act (2012) and are hence subject to the public legislation and procedures that they have to adhere to (GoK, 2016). Trends across the world show a growing demand for information systems for universities. Public universities have been running manual systems, pushing paperwork, for ages. They have had cumbersome working procedures and this has led to low productivity occasioned by highly incompetent manual systems.

Nyandiere, Kamuzora, Lukandu, & Omwenga (2012) postulate that most of the universities have implemented one form of computer-based information system (CIS) or other to facilitate their operations. Fourie & Poggenpoel (2017) acknowledges that a supply chain approach to managing business operations, on the one hand, advocates the alignment and integration of key business processes across the entire supply chain with particular emphasis on efficiency, responsiveness and agility. Adebanjo, Teh & Ahmed (2018) accentuates that supply chain integration capabilities advocates for mutual information sharing, risks and rewards and mutual cooperation, as well as sharing of the same goals and focus on serving customers, while building and maintaining long term relationships with supply chain partners.

Reviewed studies support propositions that supply chain integration is central to superior supply chain performance. As discussed, 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. Further, 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 supply chain performance in 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 role of information technology infrastructure and government policy in the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

1.3 Research Objectives

The general and specific objectives of the study were:

1.3.1 General Objective

The General objective of this study was to assess the influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

1.3.2 Specific Objectives

Specific objectives that guided the study were to:

1.3.2.1 Determine the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya.

1.3.2.2 Establish the influence of supply chain process integration capabilities on information technology infrastructure of public universities in Kenya.

1.3.2.3 Assess the influence of information technology infrastructure on supply chain performance of public universities in Kenya.

1.3.2.4 Establish the mediating effect of information technology infrastructure on the relationship between supply chain process integration and supply chain performance of public universities in Kenya.

1.3.2.5 Determine the moderating effect of government policy in the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya

1.3.2.6 To establish the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya.

1.4 Research Hypotheses

This study was guided by the following null hypotheses:

H_{01} Supply chain process integration capabilities have no significant influence on supply chain performance of public universities in Kenya.

H_{02} Supply chain process integration capabilities have no significant influence on information technology infrastructure of public universities in Kenya.

H_{03} Information technology infrastructure has no significant influence on supply chain performance of public universities in Kenya.

H_{04} Information technology infrastructure has no significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

H_{05} Government policy has no significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

H_{06} The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is not significantly different from their individual effects.

1.5 Significance of the Study

Public universities globally are expected to develop, nurture and harness competent skills that emasculate the economic development of their respective economies. In Kenya this is envisioned in vision 2030 of which the Kenyan budgetary allocation much of it goes to public universities in form of grants and research. Given that these monies are public funds, they should be utilized in a more profound manner as outlined in the public procurement guidelines.

To succeed in the digital economy, organizations are expected to manage the integration of business, technology, people and processes not only within the enterprise but also across extended enterprise of which Kenyan universities are not exceptional. An increase in the level of supply chain integration will provide rapid access to required source of information, more sensitivity toward the needs of customers, cost containment and enabling faster response time, transparency, accountability, and achieving value for money for citizens and taxpayers. - creating a competitive edge among public universities in Kenya.

1.6 Justification of the Study

SCM is now recognized by business organization as a means by which they can gain competitive advantage and improve business results. Effective SCM therefore becomes a strategic factor in universities' success. This is particularly the case as businesses link their advantages together and start to operate as supply networks of inter dependent supply chain partners as opposed to separate stand alone and arm's length entities. Associated with such an approach is the integration of inter and intra business processes in order to optimize the whole.

Yunus & Tadisina (2016) affirms that an effective supply chain network can effectively outperform the stand alone model in terms of superior performance manifesting itself as performance advantages on aspects such as supply chain lead-time, delivery reliability, ability to respond to customer demand changes and inventory control. Effective SCM therefore is central issue for competitiveness and is linked to value growth (Pietrzak, Paliszkiewicz & Klepacki (2015).

The study contributes valuable knowledge to the fields of supply chain process integration capabilities and supply chain performance of public universities in Kenya. The study anticipated to produce hitherto valuable knowledge on the subject given that no other known study has used the variables as combined in the proposed study. This is expected to provide crucial reference material for researchers, scholars and other readers. Research recommendations are expected to inform policy formulation in public universities in particular and other organizations generally given that they are obtained through valid and reliable research data.

The study will hopefully contribute to making possible more informed and effective decisions in government - university relations and governance of universities as well as their internal management.

The study is expected to enhance the practice of management of public universities in Kenya. In an effort to deal with the challenges associated with procurement and supply chain management, those charged with managing public universities can be able to focus on specific aspects of supply chain process integration capabilities, information technology infrastructure and government policy and how they affect the supply chain performance of public universities.

The utilization of such specific knowledge can help in improving standards in public universities, caliber of graduates and research candidates in the universities.

1.7 Scope of the Study

The study specifically sought to determine the influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya and was conducted between September, 2017 and September 2018. The study was grounded on four theories: Agency Theory, Resource Based View, Collaborative Network Theory and Resource Dependency Theory. The study adopted a descriptive survey research design and a census of all major public universities spread across Kenya.

Data was collected by the researcher and two research assistants using a structured questionnaire. The study interrogated heads of Procurement and ICT departments in the 31 public universities. Analysis included both descriptive and hypotheses testing.

1.8 Organization of the Thesis

The thesis is divided into five chapters. Chapter One is the introduction and provides the background of the study and the research problem. The chapter also discusses research objectives, research hypotheses, significance and justification of the study. Chapter Two is dedicated to review of literature related to the concepts and constructs incorporated in the study. The chapter presents discussion of theoretical perspective of the study and the linkages between the concepts of supply chain process integration capabilities, information technology infrastructure, government policy and performance of public universities. The chapter also presents the conceptual framework and conceptual hypotheses of the study.

Chapter three explains the methodology adopted in the study. The chapter describes the philosophical orientation, research design, and population and sample design. This chapter also discusses the method and procedure of data collection, tests of reliability and validity of the measurement scales, tests of regression assumptions and statistical techniques used to summarize the data and test the research hypotheses.

Chapter Four presents data analysis, findings and discussion of results. Results of descriptive statistics of the profiles of the studied universities and study variables are presented. The chapter also presents the results of tests of hypotheses and discussion of the results. Chapter five presents a summary of major findings of the study and conclusions of the study. The chapter also discusses implications of the study for management, theory, policy and practice, limitations of the study and direction for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter examines literature related to the study. It discusses the theoretical perspective of the study and linkages between the study variables. The chapter concludes with a conceptual framework and conceptual hypotheses.

2.2 Theoretical Foundations

Sekaran & Bougie (2016) posit that a theoretical framework is a conceptual model of how one makes logical sense of the relationships among the several factors that have been identified as important to the problem. A theory is a set of statements or principles devised to explain a group of facts or phenomena especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. Theories are analytical tools for understanding, explaining, and making predictions about a given subject matter. A formal theory is syntactic in nature and is only meaningful when given a semantic component by applying it to some content. This research was based on four theoretical perspectives: Agency Theory (AT), Resource Based View (RBV), Collaborative Network Theory (CNT) and Resource Dependence Theory (RDT).

2.2.1 Agency Theory

Panda & Leepsa (2017) assert that the Agency Theory is concerned with agency relationships that exhibits agency problem of the age-old problems that continued since the evolution of the joint stock companies. This problem has changed over time and has taken different shapes and literature. The debate on Agency Theory is about understanding the agency problem, its different forms and costs involved (Byrne & Power, 2014). When two parties are involved in an agency relationship they cooperate and participate in an association wherein one party (the principal) delegates decisions and work to another (an agent) to act on its behalf.

The important assumptions underlying Agency Theory are that potential goal conflicts exist between principals and agents, each party acts in its own self-interest, information asymmetry frequently exists between the parties and that agents are more risk averse than the principal, and efficiency is the effectiveness criterion. An agency problem appears when agents' goals differ from the principals' and it is difficult or expensive to verify whether agents have appropriately performed the delegated work (Fayezi, O'Loughlin & Zutshi, 2012).

This problem also arises when it is difficult or expensive to verify that agents have the expertise to perform the delegated work that they claim to have. A risk-sharing problem arises when principals and agents have different attitudes towards risk that cause disagreements about actions to be taken (Zogning, 2017). Agency Theory determines how procurement managers execute procurement practices on behalf of universities. Existence of poor principle agent relationship leads to low level of top management commitment and this also affects the relationship between universities and the suppliers.

The existence of conflict of interest amongst the agents leads to execution of procurement practices against the procurement policies and this leads to increased procurement budget and loss of procurement funds. This study thus used the Agency Theory to determine the moderating effects of government policies in the relationship between supply chain process integration capabilities, information technology infrastructure and performance of public universities in Kenya. Principal-agent relationships are enacted in a broader supply chain integration perspective for the implementation of policies geared towards aligning incentives so as to discourage self-seeking behavior and bounded rationality by agents hence reduce agency costs (Byrne & Power, 2014). In addition, the operational nature of supply chain expenditures decisions must be taken by the firm's management (agents) on behalf of the company proprietors (principals) under the authority entrusted to them through employment. The Agency Theory therefore contends that, the goals of the principal and agents are not in conflict and that the principal and agent can reconcile different tolerances for risk (Panda & Leepsa 2017). Both principal and agent seek to maximize their utility from the same organizations. The trouble faced by the principal is how to secure some service benefit from the agent while not knowing the true value of those benefits, or being forced to accept those benefits the agent wishes to supply (Fayezi, O'Loughlin & Zutshi, 2012).

2.2.2 Resource Based View

The Resource Based View (RBV) is a theory that was developed by Barney and Wernerfelt in 1930s in their analysis of heterogeneous firms which introduced the idea of resource position barriers being roughly analogous to entry barriers.

The Resource Based View of the firm is one of the most widely accepted theoretical perspectives in the field of strategic management in explaining organizational performance (Barney, 1991). Resources are stocks of available factors owned or controlled by a firm while capabilities are the firm's capacity to deploy resources. RBV assume that firm's bundles of resources are heterogeneously distributed across different firms (Matopoulos, Barros & Van der Vorst, 2015). These same authors aver that Resource-Based View has since become one of the dominant contemporary approaches to the analysis of sustained competitive advantage. The argument is that no two companies are alike because they have had the same set of experiences, acquired the same assets and skills or developed the same cultures.

This has led to scholars such as Chae, Olson & Sheu, (2014) to theorize what; when a firm achieves competitive advantage the firms' resources are rare, valuable, or inimitable and non-substitutable. The focus is on how competitive advantage is generated, sustained over time within specific firms. Resource Based View perceives that unique deployment patterns of unique resources and capabilities is the basis on which competitive advantage of a certain firm is built and can be a primary determinant of superior performance. There is consensus in the strategic management conversations on the role of firm resources and capabilities in explaining why firms differ in the creation and sustenance of competitive advantage (Matopoulos, Barros & Van der Vorst, 2015). They connote that resources are not valuable in themselves but because they allow firms to develop and implement value-creating strategies that create advantages in particular markets. Thus, resources and capabilities can be thought of as a platform from which the firm derives various products for various markets that enable the firm to develop competitive advantage.

Chae, Olson & Sheu (2014) emphasize that a firm's basic competence which includes coordination of different types of production knowledge and the competence of integrating multiple technological flows. Equally the same scholars have emphasized the uniqueness that an organization has that contribute to performance. Hence, issues like environment (market competition), internal factors, firm strategy, structure, system and people, competence and capabilities and assets size and financial capabilities have become the explanatory factors in explaining performance.

Kamasak (2017) established that most RBV researchers choose to look within the enterprise and down to the factor market conditions that the enterprise must contend with, to search for some possible causes of sustainable competitive advantages holding constant all external environmental factors. Sanderson, Lonsdale, Mannion & Matharu (2015) argued that the bonding effect of relationship-specific investments based on RBV can be one of the most important determinants of buyer-supplier relationships. Sanderson et al., (2015) posits that a firm's resource must, in addition, be valuable, rare, and imperfectly inimitable and non-substitutable in order to be a source of a sustained competitive advantage.

Duffy et al., (2015) postulated that each firm is characterized by its own unique collection of resources of core competencies. The authors identified distinctive capabilities as arm's length relationships, which are associated with low asset specificity and low supplier competencies that cannot easily be bought off the shelf as there are many potential suppliers, internal contracts, which is an in-house provision associated with high asset specificity and core competencies and partnership relationships.

This applies to assets of medium specificity and ascends in steps according to the distance of the complementary competencies as provided by external suppliers from the core competencies of a particular firm. According to Veerendrakumar, Narasalagi & Shivashankar (2015) the source of competitive advantage is the creation and exploitation of distinctive capabilities that are difficult to build and maintain, codify, make into recipes that are hard to copy, emulate, and cannot simply be bought off the shelf. Further these authors established three basic distinctive capabilities, corporate architecture, innovation and reputation.

The Resource Based View focus of SCM research in recent years has shifted from the narrow operating efficiency considerations to the effective resources or capabilities development that emphasizes collaborative R&D and innovation (Wang & Ran, 2018). Collaborative research and development, and innovation reflect the characteristics of win-win cooperation in SCM which contributes to maximizing their mutual interests that benefit the whole supply chain (Aschhoff, 2018). Greater supply chain collaboration has important strategic significance to the boundary-spanning of a supply chain, because they need to utilize the resources and knowledge of their partners to enhance innovation capacity that could not be accomplished solely by them (Festel, De Nardo & Simmen, 2014). The systems are built upon the communication and trust mechanism and the benefit and risk sharing mechanism. This makes it possible for the collaborative R&D of the supply chain to be launched successfully in a format of a series of detailed arrangements, such as clear divisions of labor, intellectual and intangible property ownership, cost-sharing, and opportunism prevention.

Huo, Han & Prajogo (2016) posit that RBV is relevant to the study of supply chain process integration and information technology infrastructure, because SCPI and IT are considered structure-related variables, as the internal process integration changes and defines the rules and routines that people need to follow. Hunt & Davis (2012) suggested that external relationships have to be internalized and be considered as a part of organizational structure. Duffy et al., (2015) aver that integration in essence is the structure realignment that focuses on optimal resource configuration. The RBV is also relevant because the purpose of supply chain process integration is to better allocate resources within and across firms. Resources are the key input factor in the RBV and acquiring a unique bundle of resources is critical to a firm's success. These studies provide interesting accounts on the use of RBV in the context of supply chain practices, and performance. Therefore, the RBV is considered the main lens in this research that focuses mainly on supply chain integration capabilities of firms.

According to Duffy et al., (2015) superior performance achieved in supply chain activities relative to competitors, explain how these activities can be supported by supplier-customer relationship management can contribute realization of the supply chain targets. RBV helps to explain how firms derive competitive advantage by channeling resources into the development of new products, processes, and so forth. As market environments change, firms must adopt innovations over time and the most important innovations are those allowing the firm to achieve some sort of competitive advantage, thereby contributing to performance.

Innovative capability rooted in process integration involves complex development procedures and knowledge contributions from various parties within and outside a firm, making it a superior distinctive capability (Wang & Ran, 2018).

2.2.3 Collaborative Network Theory

The effectiveness of the cooperation between the firm and its partners and partners' partners is a key determinant to firm's performance (Festel, De Nardo & Simmen, 2014). The Collaborative Network Theory (CNT) is used as the foundation of the reciprocal effect in inter-firm relationships. Firms have chosen a more integrative management style with a focus on collaborations along the supply chain as a whole in order to remain competitive abandoning the antagonistic approach (Aschhoff, 2018). The interaction between the different firms and other players in the tiers of the supply chain is vital due to conflicting members' interests and the interests of the whole supply chain (Von Haartman & Bengtsson, 2015). An effective relationship among supply chain partners can help facilitate a combination of the resources owned by the firms. Resource combination results in better outcomes than those achieved by a single firm acting alone.

CNT argues that the value of the resources can be expanded by its combination with other resources, then building effective inter-firm relationships within the network or supply chain can be more important than resource possessions per se (Festel, De Nardo & Simmen, 2014). Network relations create information sharing that enables buyers and sellers to have access to resources and knowledge beyond their abilities, leading to long-term relationships (Yeng *et al.,* 2015). Network Theory can be used to provide a foundation for the hypothetical analysis of reciprocity in cooperative relationships (Aschhoff, 2018).

In this case, the firm's constant interaction with other supply chain partners becomes a vital factor in the development of new assets (Yeng *et al.,* 2015). Relationships combine the resources of two organizations to achieve more advantages than through individual efforts (Wang & Ran 2018). In Network Theory, types of collaborations are not only based on economic factors but also on power and trust (Cao & Zhang, 2013). According to Wang & Ran (2018) this framework provides a guidance to coordinate the different individual interests effectively by decision-making committee, working through mechanisms such as benefits and risks sharing and communication and trust encompasses a holistic picture of the supply chain lifecycle. Contractual integration - For firms that have established stable supply chain partners based on contractual relations, the evolution of the supply chain is from contractual integration phase to bilateral integration phase where benefit and risk sharing, conflict resolution, and collaborative R&D will play a greater role in achieving their mutual strategic missions of win-win integration. Bilateral integration is for firms whose internal integration has not been achieved yet and who do not have a clear strategic goal and stable business partners.

The evolution of a supply chain is from the disorderly development phase to the contractual integration phase, involving accelerating firms' internal functional integration and strengthening communication and trust in order to stabilize and extend their business as the top priority. Holistic integration is the holistic perspective that offer the decision-making committee a method for describing and analyzing problems from such holistic perspective, rather than fall into the trap of focusing on one particular phase losing the sight of the overall supply chain lifecycle movement. This aims at improving supply chain overall performance and competitiveness.

The evolution from bilateral integration phase to holistic integration phase will also entail that supply chain managers need to adopt any necessary mechanisms, including restructuring the supply chain situational and dynamically to benefit the whole supply chain. Festel, De Nardo & Simmen, (2014) asserts that the significant contribution of CNT to the determination of the inter-firm relationships is the role played by supply chain partners who yield to trust via supply chain collaborations such as communication as well as mutual adoption in terms of management systems and culture hence the firms' performance. Through establishing information sharing and collaborative communication, firms can build relationships with their supply partners through the social exchange process to improve their performance.

In CNT, a network is believed to be in a state of dynamic momentum, rather than a point of optimal equilibrium (Kembro & Naslund, 2014). Hence the collaborations between firms and their supply chain partners aim to govern such dynamics, which include exchange process, information, products, and technical, legal. In supply chain management Collaborative Network Theory has been applied to map the supply chain in terms of activities, actors and flows of resources. Kaibara de Almeida, Marins, Salgado, Santos & Luis da Silva, (2015) depicts that the main focus of CNT is to develop long-term relationships by building mutual trust between supply chain partners.

SCM is an interaction between a firm and various outside entities. Upstream and downstream partner involvement, integration and collaboration are important routes to performance improvements in organizations. According to Govindan, Popiuc and Diabat (2013), inadequate investigation of internal and external coordinating mechanisms collectively amongst organizational and inter-organizational networks has been studied. External cooperation amongst organizations may not provide significant performance improvements nor be successful without proper internal cooperation. It has been found that firms with well-developed internal and external interfaces perform better than their counterparts only with sound internal interfaces.

According to Cao & Zhang, (2013), Network Theory proposes that the value of the resources can be expanded by its combination with other resources, then building an effective inter-organizational relationship within the supply chain. Network Theory is used as the basis of the reciprocal effect in inter-organizational relationships explaining why firms ought to collaborate. Hence, the interactions between different organizations and other players in the layers of the supply chain become very critical in the success of supply chain integration (Scholten & Schilder, 2015). Information technology helps to communicate between upstream and downstream partners hence creating a virtual supply chain that is information based rather than inventory based. Virtual supply chain ensures that information is shared among partners thereby forming a process alignment through collaboration that is linked together as a network. Electronic Data Interchange (EDI) and the internet have made it possible for partners in the supply chain to share the same data rather than waiting for that extended chain to transmit data from one step to another.

The universities that are market driven can easily realize agility by investing in product research and modern information technology that enables them to react quickly to the fluctuations in product demand and sourcing problems.

2.2.4 Resource Dependence Theory

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 & 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, Williams & Kwong (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 & 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. Given that this study sought to provide understanding of the linkage between supply chain process integration capabilities and supply chain performance, RBV was the main theory that guided this study. However, CTN, RDT and Agency theory played complementary roles in examining the influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities.

2.3 Empirical Studies

Zhang & Huo, (2012) in their study on the impact of dependence and trust on supply chain integration, investigated the joint influence of dependence and trust in supply chain relationships on supply chain integration and financial performance. Structural equation modeling conducted based on empirical data that was collected from 617 manufacturers in China such as arts and crafts, building materials, chemicals and electrical, food and beverage, jewelry, pharmaceutical and medical, publishing and printing and other industries. Reliability, validity and structural equation modeling method were used. The study found out that trust with customers/suppliers significantly influenced supply chain integration. The study also established that both supplier and customer integration significantly improved financial performance. The study made a contribution by examining the linkage between trust and dependence in supply chain relationships on supply chain integration and financial performance.

However, the study did not examine the moderating effect of government policy and mediating effects of information technology on supply chain performance and non-financial performance.

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 collected from 199 employees from purchasing and supplies sections drawn from 65 KTDA managed factories in Kenya. The findings indicated that 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). The study by Cheruiyot, however, did not consider the influence of information technology integration and government policy on the relationship between supply chain integration and supply chain performance. Additionally, this study was done in manufacturing sector in Kenya.

Ageron, Gunasekaran, & Spalanzani, (2013) conducted exploratory research with a focus to examine and evaluate the importance of IS/IT criterion in the suppliers selection process. The study objective was to assess if there was superior supply chain performance arising from the integration of this criterion and to determine difficulties companies face resulting from this deployment. In the study, the authors reviewed previous literature on supplier selection and designed a structured questionnaire for their data collection. Data were collected from 90 French companies and subsequently analyzed to understand the IS/IT criterion used for supplier selection along the upstream value chain. In the findings, it was established that IT/IS is a significant supplier selection criterion within supply chain context because of the rapid proliferation of information sharing across upstream chains.

Nevertheless, the literature reviewed highlighted that traditional criteria remain the most studied: 68 articles were related to quality, 64 were on delivery and 63 questioned the price criterion. In this regard, only 25 articles dealt with technology topic whereas the use of IS/IT have been frequently associated with significant supply chain efficiency improvements. Schneider or Hewlett Packard which emphasized the importance of use of Intra- or- inter-Organizational Information Systems (IOIS) in their relationships with their supply chain partners, have implemented or are in the process of implementing Information Technology/Information Systems (IT/IS) to sustain an integrative supply chain. Because improvements in SCM cannot be only achieved within the organization but also outside with upstream and downstream partners, companies have to manage their suppliers in terms of IT/IS application. The study made contribution in the understanding of the influence of information technology in supply chain management especially the supplier selection criterion. The study did not examine information technology infrastructure's internal and external integration on supply chain performance. The study was also conducted in France and the findings may not be generalized to Kenya.

Njagi & Ogutu (2014) studied the impact of supply chain integration on supply chain performance in State Corporations in Kenya. A census study was conducted where a total of fifteen (15) corporations were studied in order to assess the level of upstream and downstream integration and the relationship between integration and performance of state corporations. The study findings revealed a positive and significant correlation between supply chain integration and supply chain performance of the state corporations in Kenya. The study contributed to knowledge by shading more light on the relationship between supply chain integration and supply chain performance.

However this study conceptualized integration in terms of upstream and downstream and was in state corporations which exclude universities.

Vanichchinchai (2014) sought to assess the level of supply chain management practices, total quality management practice on firm's supply performance in the automotive industry in Thailand. The study used 211 questionnaires. The study employed descriptive statistics that tested reliability and validity. The MONOVA test was applied to accentuate the differences between study variables. The study established that organizations that applied supply chain management practices and total quality management practices achieved a higher level of firm's supply performance than those that did not.

Wasike & Ogollah (2014) examined the relationship between information systems and supply chain agility in service industry. The study adopted a case study design and collected data from 96 top, middle and lower level staff of the Technical University of Kenya. The study found that information system was critical on improvement of supply chain agility. The study recommended that resources (people, machines and the necessary application software) must be available to promote supply chain agility and that investment in training and development of staff as well as incorporation of modern IT processes such as cloud computing will greatly improve university's supply chain agility.

Ombuki, Arasa, Ngugi, and Muhwezi, (2014) conducted a study on determinants of procurement regulatory compliance by public universities in Kenya. The study indicated that political factors influenced the regulatory compliance in the public university in Kenya. The most influential politician was the member of the women representative whose influence accounted for 95.5% of the overall.

The study recommended that politicians should be well-educated on the need to comply with the government's procurement rules and regulations.

Tiryakioğlu & Yülek, (2015) carried out selective literature survey of academic research and policy experience on public procurement policies utilized to foster technological development using descriptive research design, descriptive statistics and correlational analysis. The study established that in the Turkish case, some policy texts had been prepared; revealing that some form of "development-based procurement" policy was considered. However, current experience showed that most of the practical policy concentrated on military offsets. The study was limited to public procurement policies utilized to foster technological development.

Srivastava & Maitra (2016) conducted a study to introduce a methodology to identify Key Performance Indicators (KPI) for supply chain that can be used for sustainability performance evaluation for suppliers. The study first discussed the complexity of supply chain performance measurement. Then a two-stage method utilizing neighborhood rough set theory was used to identify KPI and Data Envelopment Analysis (DEA) to benchmark and evaluate relative performance using the KPI. Additional analysis was performed to determine the sensitivity of the KPI set formation and performance results. The study also used the Supply Chain Operations Reference (SCOR) model which categorizes the processes of five supply chain stages including plan, source, make, deliver and return. The study focused on the source function due to a focus on suppliers and performance measures within SCOR were categorized on cost, time, quality, and flexibility and innovation dimensions.

Gimenez, (2011) aimed at investigating the effectiveness of supply chain integration in different contexts where supply complexity was the moderating construct. A survey-based research design was developed to measure different dimensions or aspects of supply chain integration and supply complexity. Data was collected from manufacturers in the Netherlands and Spain from different industries such as manufacture of pulp, chemicals, radio and television, medical instruments, motor vehicles and machinery and computers. A total of 145 completed questionnaires were collected of which 80 were from Netherland and 65 from Spain. This study used factor and regression analyses. The findings revealed that supply chain integration increased performance if supply complexity was high, while a very limited or no influence of supply chain integration can be detected in case of low supply complexity. The results equally showed that in high supply complexity environments the use of structured communication means to achieve supply chain integration had a negative effect on cost performance.

Mikihisa & Oji (2017) explored how firms' can realize continuous supply chain process improvement. Specifically, the study proposed success factors of routinized activities in the supply chain process improvement. Eight Japanese manufacturers were selected for the case studies. These firms were selected based on their supply chain process operation capabilities. The findings of the study were that the planning of supply chain process improvement depends on the existing stages of the firm's supply chain management reform. In addition, even firms with high scores for supply chain process operation capabilities do not have supply chain performance systems.

The study contributed to the understanding of the success factors of routinized activities in the supply chain process improvement. The study was done in Japanese manufacturing sector using financial performance measurements. The study focused on supply chain improvement factors and did not use information technology infrastructure and government policy as mediating or moderating variables.

Wong & Wong, (2011) studied the contingency effects of the environmental uncertainty on the relationship between supply chain integration and operational performance. Multi-group and structural path analyses of survey were collected from 151 of Thailand's automotive manufacturing plants. The study findings revealed a positive relationship between supply chain integration dimensions and operational performance dimensions. The study by Wong & Wong, (2011) made a contribution in understanding the role of contingency effects of the environmental uncertainty on the relationship between supply chain integration and operational performance. However, the study was inclined to automotive manufacturing. This did not examine the influence of moderating variables and intervening variables such as government policy and information technology infrastructure, the study also used financial measures of performance.

Reviewed studies support propositions that supply chain integration is central to superior supply chain performance. The studies also were inclined to manufacturing contexts and in western countries which can be different from the service firms. However, none of the reviewed studies examined the influence of information technology and government policy on the relationship between supply chain process integration capabilities and supply chain performance.

2.3.1 Supply Chain Process Integration Capabilities and Supply Chain Performance

Researchers have focused their research on supply chain process integration by heavily relying on un-dimensional supply chain relationships by examining collaborative relationships between manufacturers and either of its customers (Chopra & Meindl, 2016). This finding established several flows across the supply chain in materials, information and finances (Lee, Chung, Lee, Gan & Chou, 2016). The measurement of performance has been very complicated as different methods have been used. Performance studies in relation to SCI can be classified into three groups of the relation between internal SCI and performance, between external Supply Chain Integration (SCI) and performance or both types of SCI with regards to performance. Research articles have clearly argued and have provided evidence concerning the positive impacts of SCI on performance either through explicit or implicit consideration (Pierre, Richard, Devinney, Yip & Gerry, 2015).

Hefu, Ke, Wei & Hua (2016) investigated the impact of two different dimensions of supply chain integration on two aspects of firm performance in the emerging economy of China. In addition, the moderating effects of market orientation on the relationship between supplies chain integration and firm performance. This study determined that operational coordination is positively associated with operational performance and business performance. Information sharing affects only operational performance; it has no impact on business performance. The study also provided empirical support for the moderating effects of market orientation on the association of supply chain integration and firm performance.

In their study Mikihisa & Oji (2017) explored how firms' could realize continuous supply chain process improvement. Specifically, this study proposed success factors of routinized activities in the supply chain process improvement. Eight Japanese manufacturers were selected for the case studies. These firms were selected based on their supply chain process operation capabilities. The findings were that the planning of supply chain process improvement depends on the existing stages of the firm's supply chain management reform. In addition, even firms with high scores for supply chain process operation capabilities do not have supply chain performance systems. Lee et al., (2016) asserts that information flow integration enables linkages with internally between the business units, supplier and customer linkages.

Omneya & Rasha (2018) adduced that integration through efficient and effective flow of information will eventually lead to better supply chain and individual firm's performance. Physical flow on the hand is the use of global optimization with supply chain partners to manage the materials and finished goods flow from source to ultimate consumer. Chul-hwan, 2018) confirms that whenever there is integration between suppliers and their customers' internal processes there is a reduction of costs and an improvement in product quality and general productivity of manufacturers through cost reduction, reliable deliveries, improved inventory and supplier management and in particular, physical flow integration contributes significantly to the firms performance and finally to the total supply chain partners.

Lee et al., (2016), posit that for workflow events to function well, it is imperative that the exchange of financial resources between a focal firm and its supply chain partners brings out financial flow integration. The activities required to facilitate the flow of funds across the supply chain involves invoicing of customers, paying suppliers and internal transfers which improves cash conversion cycle or cash-to-cash cycle through reduced days-in-inventory, shortened days-in-receivables and prolonged days-in-payables. Financial flow integration is essential for effective and efficient management of supply chain performance (Alexander Walker & Naim, 2014).

Tangpong, Michalisin, Traub & Melcher (2015) posit that the core aspect behind SCM is the integration of internal processes with the suppliers and customers. Effective communication by use of internet, web-based systems enable inter-organizational communication which is considered as being frequent, genuine, and involves personal contacts between buying and selling personnel. This also involves inventory management, demand forecasting, and customer and supplier relationship management. Equally Yunus & Kurniawan (2015) share views in support of information sharing in the supply chain management. The first view involves information sharing throughout the supply chain which is a necessary tool for having an effective and competitive supply chain. The reason for this is that it allows the coordination of material flow and financial flow in the supply chain, which results in lower inventory costs across the chain and more efficient use of resources (Lee & Cho, 2014).

Caridi, Moretto, Perego & Tumino (2014) confirm that information sharing leads to improved forecasting, demand planning and replenishment, and results to higher sales, improved inventory management and better understanding of demand hence reducing the bullwhip effect.The benefits gained from information sharing are represented by determining what information to share and with who is compared to the high costs associated with the information technology implementation and the issue of complexity. Yunus & Kurniawan (2015) assert that joint solutions to material problems and design issues in supply chains, partners must be committed. The partners must be willing to share sensitive design information that can be achieved through engineer-to-engineer communication on design issues, in order to improve process capability, manufacturability, and performance without affecting profit margins.

Jiguang & Bing (2018) connote that there are two types of information; operational information that include information shared on a daily basis related to sales, logistics activities such as delivery schedules, inventory levels, production schedules and order status help to reduce cycle time, inventory levels, improve service levels; and strategic information is associated with sharing marketing, logistics resources planning, capacity planning and long-term forecasting information. Collaboration and planning for future logistics practices is improved across the supply chains for long-term competitiveness through this type of information (Veerendrakumar, Narasalagi & Shivashankar, 2015).

Jiguang & Bing (2018) opine that an efficient and effective information sharing platform is considered a critical component of a supply chain design which contributes to a better partnership and integration. This platform should be designed to enable the whole supply chain to share essential market and operational information, improve productivity, and reduce transaction cost and time-to-market. Pan and Shu-ping (2016) aver that in a centralized information platform, partners of the supply chain will continuously update operational data required by the decision-making committee, monitor the critical situation as reflected by the updated data, and coordinate the daily operational schedule based on the information in the platform.

According to Susanne & Pietro, (2018) effective decision making is based on knowledge acquired and disseminated to diverse partners in the supply chain and that globally research has confirmed that converting knowledge resources into value requires a proper governance framework because knowledge is only valuable when it is put to proper use. Thus, the governance framework for information sharing platform facilitates operations, monitors critical information, triggers responses, and manages knowledge. Specifically, the framework enables supply chain partners to optimize their operations with improved returns to benefit all the partners thus further consolidating partnerships and moving the supply chain in a positive direction. In the perspective of RBV organizational resources and capabilities underlie and determine a firm's capacity for innovation. Equally, these knowledge resources provide the necessary inputs for the development and exploitation of a firm's innovation activities to enable the firm adapt to the rapidly changing environment and create competitive advantage (Matopoulos, Barros & Van der Vorst, 2015).

The process of acquiring, storing of raw materials, components, and finished goods is referred to as material management (Qureshi, Iftikhar, Bhatti, Shams & Zaman, 2013). The physical distribution relates to activities such as order processing, inventory deployment, storage and handling, and transportation. Material Management (MM) enables efficient flow of raw materials and finished goods across the different functional units in the organization. Material flow needs to be synchronized in a way that prevents build-ups and interruptions of inventory (Qureshi et al., 2013). This has led firms to implement several practices and initiatives for synchronizing the flow of material with their suppliers and customers. According to Silvestro & Lustrato (2014) firms that have a well-coordinated flow of material enable firms to deliver products to end customers in a timely, efficient and effective way. Gualandris, Klassenb, Vachonb & Kalchschmidt (2015) describes logistics management refers to planning the flow of material and related information in an efficient and effective manner across the supply chain. Jin & Edmunds (2015) assert that one of the most widely cited definitions of logistics in literature is the definition of the council of supply chain management professionals (CSCMP).

Lee et al., (2016) define financial flows to include both the upstream and downstream actors in the supply chain. The downstream viewpoint of financial resources includes prices, invoices, and credit terms whereas the upstream resources include payments to suppliers and account payables. Therefore, financial flow was considered by some authors as a key element of the supply chain. Silvestro & Lustrato, (2014) confirm that effective flow of financial resources between the focal firms and its suppliers and customers results in shorter cash-to-cash cycle by reducing days-in-inventory, shortening days-in-receivables and extending days-in-payables.

Abdallah & Alnamri (2015) conducted a study to investigate the use of financial and non-financial performance measurement practices, including the use of the Balanced Scorecard (BSC) and the impact of the cultural values on the use of Performance Measurement Systems (PMSs), in Multi-National Companies (MNCs) operating in the Middle East with a special attention to the Saudi Arabian subsidiaries. The duo collected data using a survey mailed to 180 randomly selected Saudi manufacturing subsidiaries in different industrial cities to collect data on their PMSs including the use of the BSC. In the research findings, financial measures were more widely used by most of the companies included in the sample due to the fact they were common, well known, and the most familiar performance measures in the business practice and they are more standardized measures which can be easily understood, implemented, and quantified. Moreover, the use of the non-financial measures was at a very low rate compared with the use of financial measures. The reasons were the difficulty in finding objective measures of the effect of social actors and the avoidance of any disclosure of social problems that are existed in the society.

In the research finding, the measures were classified in a descending order of the ones most widely used, as indicated by the highest mean, to the ones least widely used as indicated by the lowest mean among all measures. The financial and non-financial indicators employed in the study were, total sales, rate of achieved budget, unit product cost, rate of return on investment, number of customers' complaints, customer response time, rate of the growth sales, rate of defective output to total output, rate of market share, actual profit margin, measure of defective units, number of warranty claims,

Time for new product development, customer satisfaction, rate of new products launched, on-time delivery, Number of new employee training/hours programs and employees' satisfaction.

2.3.2 Supply Chain Process Integration Capabilities and IT Infrastructure

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 & 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, Luo, Basnet, Ahn, Lee & Vossen (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).

2.3.3 Information Technology Infrastructure and Supply Chain Performance

According to Tina (2013) Johnson and Johnson Company faced new business pressures when large customers, such as Wal-Mart and K-mart made new demands on the company basing on cost savings and just-in-time stock replenishment. The company's business and IT managers acted in partnership to develop a new set of IT infrastructure capabilities which enabled the company to provide the necessary services for its large customers while at the same time reducing costs at the company (Wagner & Bode, 2014). Equally at the same time Charles Schwab focused on delivering customized information to its investors in a timely manner by using the company's IT infrastructure and applications aligned with its business focus that had made Schwab became a full- service beverage firm. Due to this according to Wagner & Bode, (2014) the firm was able to provide information and process transactions in meeting its business objectives. This made her customers' to retrieve stock quotes and place orders via Schwab's Web site, which made the corporation to be an industry leader. Tina (2013) opines that the capability building processes and actions in firms tie IT infrastructure capabilities with the development of customer management capability. 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.

According to Deepak & Saji, (2016) the perspective of an integrated IT infrastructure enables consistent and real-time transfer of information between SCM-related applications and functions that are distributed across partners. The integrated IT infrastructures for SCM can be blended with inter-organizational processes to develop higher-order capabilities for demand sensing, operations and workflow coordination, and global optimization of resources. Tiwari, Tiwari & Samuel, (2015) affirm that IT 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. Another significant business partner and a high level of IT infrastructure enables firms to design metrics and analytics to provide visibility into the real-time performance of various processes, the integration between the various processes and advance warnings about performance degradation in processes and finally a high level of IT infrastructure capability enables faster and more responsive redesign and reconfiguration of processes in responses to changes in business conditions.

According to Tina (2013) internal infrastructure integration is the degree of coordination between functions within the organization. IT provides opportunities for universities to communicate with one another through email, mailing lists, chat rooms, and also provides quicker and easier access to more extensive and current information, and it can be used to do complex mathematical and statistical calculations. Furthermore, it also provides researchers with a steady avenue for the dissemination of research reports and findings. These findings were supported by studies that show that technology is usually a tool for addressing challenges in teaching and learning, a change agent, and a central force in economic competitiveness (Tiwari, Tiwari & Samuel, 2015).

The role of IT in education in the development of any society, the institution was indispensable in developing an ICT culture of any country, as IT can be used as a tool for addressing challenges in teaching and learning, technology has capabilities for delivery, management, and support of effective teaching and learning. It is equally good for geographically dispersed audiences, and it also helps students to collect and make sense of complex data. IT also supports diverse and process–oriented forms of writing and communication, and it broadens the scope and timeliness of information resources available in the classroom. The tool is a change agent, it catalyzes various other changes in the content, methods, and overall quality of teaching and learning, thereby ensuring constructivist inquiry-oriented classrooms. As a central force in economic competitiveness, IT deals with economic and social shifts that have technology skills critical to future employment of today's students (Tina, 2013).

Organizations must provide effective leadership in ICT integration, through research, modeling of effective integration of ICT, and provision of opportunities for professional development of citizens of a country. External integration is the degree of coordination between manufacturing firm and its downstream customers and suppliers. Internal integration involves cross functional teams that may bring together a carefully selected array of specialists who share information and make product, process, and manufacturing decisions, jointly and simultaneously (Otchere Annan & Anin, 2013). Internal integration is defined as a process of inter-functional interaction, collaboration, coordination, communication and cooperation that bring functional areas together into a cohesive organization (Wagner & Bode, 2014).

Furthermore, supply chain partners who exchange information regularly are able to work as a single entity, and can understand the needs of the end customer better and hence can respond to market change quicker. A prerequisite for successful SCM is internal integration. Companies with a low internal integration strategy will achieve low level of external integration and companies implementing the full internal integration strategy will have the highest levels of external integration (Otchere, Annan & Anin, 2013). External supply chain integration reveals two major areas of emphasis, Customer Integration (CI) and Supply Integration (SI). Supply and customer integration are the interactions and collaborations that ensure an effective flow of products and services to customer and suppliers (Wagner & Bode, 2014). Customer integration involves sharing demand information. This helps the manufacturer to understanding better the customer needs and to forecast better customer demand, as well as collaborative involvement of customers with respect to product design. This leads to provision of better quality products at lower cost and more flexibility in responding to customer demand (Tiwari et al., 2015).

2.3.4 Supply Chain Process Integration Capabilities, IT Infrastructure, and Supply Chain Performance

Pekkola & Ukko, (2016) assert that public and private sector organizations are faced with challenges in their everyday operations as there is increased pressure to compete on a global stage with limited resources. Organizations have hitherto developed supply chain management strategies to enable them secure prosperity.

Abdallah &Alnamri (2015) sought to investigate the use of financial and non-financial performance measurement practices, including the use of the Balanced Score Card (BSC) and the impact of the cultural values on the use of Performance Measurement Systems (PMSs), in Multi-National Companies (MNCs) operating in the Middle East with a special attention to the Saudi Arabian subsidiaries. This study established that financial measures are more widely used by most of the companies included in the sample due to the fact that they are common, well known, and the most familiar performance measures in the business practice and they are more standardized measures which can be easily understood, implemented, and quantified. Moreover, the use of the non-financial measures was at a very low rate compared with the use of financial measures. The reasons were the difficulty in finding objective measures of the effect of social actors and the avoidance of any disclosure of social problems that are existed in the society.

The implementation of a Customer Relationship Management (CRM) approach is likely to have an effect on customer satisfaction and customer knowledge for a variety of different reasons. According to Gu, Davis, Cao & Vogt (2017) firms are able to customize their offerings for each customer by accumulating information across customer interactions and processing this information to discover hidden patterns - CRM applications help firms customize their offerings to suit the individual tastes of their customers. This customization enhances the perceived quality of products and services from a customer's viewpoint, and because perceived quality is a determinant of customer satisfaction, it follows that CRM applications indirectly affect customer satisfaction. CRM applications also enable firms to provide timely, accurate processing of customer orders and requests and the ongoing management of customer accounts (Iqbal, 2014).

2.3.5 Supply Chain Process Integration Capabilities, Government Policy and Supply Chain Performance

With the advancement of information and communication technologies, supply chain integration has been considered a strategic tool for firms to improve their competitiveness. The supply chain integration within processes and between organizations has enhanced value creation. However, the fragmented nature of the business in developing countries demonstrates a noticeable difficulty in terms of competitiveness and efficiency (Deepak & Saji, 2016). Information technology has been captured in the studies in terms of a single variable, namely the extent to which firms have implemented an integrated enterprise resource planning (ERP) system. ERP is a standard software package that provides integrated transaction processing and access to information that spans multiple organizational units and multiple businesses. One study aimed at identifying the relationship between ERP and organizational performance (Deepak & Saji, 2016).

According to Zhou, Alain Loong, Cao & Haijun, (2016) the implementation of the ERP system has a positive effect on organizational performance; the magnitude of its impact is smaller immediately after implementation, being intensified over time. With the need to integrate key functions such as procurement and accounting and to streamline and enhance transparency in the management of public funds as well as to provide a framework for standardized reporting, the Kenya government adopted the policy requiring all government procuring entities to use the Integrated Financial Management Information System (IFMIS).

IFMS is an Oracle-based enterprise resource planning (ERP) software and integrates all data and processes of an organization into a unified system housed at the centralized database which is accessed through a secure network (GoK, 2016). According to Agyemang & Ryan (2013), IFMIS is an information system that tracks financial events and summarizes financial information. It supports adequate management reporting, policy decisions, fiduciary responsibilities and the preparation of auditable financial statements.

The role of IFMIS is to connect, accumulate, process and then provide information to all parties in the budget system on a continuous basis. It is therefore imperative that the system should be able to provide the required information timely and accurately because if it does not it will not be used and cease to fulfill its central function as a system (Zhou, Alain Loong, Cao & Haijun, (2016)). The goal of an integrated financial management system is to support the achievement of fiscal discipline, strategic and efficient allocation and use of funds, value for money and probity in the use of public funds (Gok, 2016).

According to Zhou, Alain Loong, Cao & Haijun, (2016) IFMIS assists management in ensuring accountability for the deployment and use of public resources and in improving the effectiveness and efficiency of public expenditure programs. By tracking financial events through an automated financial system, management is able to exercise improved control over expenditure and to improve transparency and accountability in the budget cycle as a whole (Affes, 2016). According to the Commission of Revenue Authority (2013), in the 2013/2014 financial year, a total of 210 billion Kenya shillings was disbursed to the county governments to facilitate their operations.

This resulted in a remarkable achievement when the government ministries reported a 42.7% drop in their procurement operating cost amounting to Ksh629 million down from KSh1.64billion in the previous year (GoK, 2014).The main objective of IFMIS is to improve the efficiency and effectiveness of the processes, involved in the management of public funds. The ultimate goal of IFMIS is to enhance the quality of public service delivery by providing timely and accurate financial and accounting information across both the National and County Governments. A properly designed and implemented procurement policy plays a pivotal role in providing a guiding framework for the implementation of effective procurement practices (David, 2014).

A procurement policy is simply the rules and regulations that are set in place to govern the process of acquiring goods and services needed by an organization to function efficiently (Sarpong et al., 2017). The exact process will seek to minimize expenses associated with the purchase of those goods and services by using such strategies as volume purchasing; the establishment of a set roster of vendors, and establishing reorder protocols that help to keep inventories low without jeopardizing the function of the operation. Both small and large companies, as well as non-profit organizations, routinely make use of some sort of procurement policy (Kramer, 2016). There is no correct way to establish a procurement policy, factors such as the size of the business, the availability of vendors to supply necessary goods and services, and the cash flow and credit of the company will often influence the purchasing procurement approach (Sarpong et al., 2017). According to Dzuke & Naude, (2017) the size of the company is likely to make a difference in the formation of procurement policy, in that a small company may not be

able to command the volume purchase discounts that a large corporation can manage with relative ease. Equally according to Kramer (2016), procurement policy benefits the organization by keeping costs in line and clearly defining how purchases are made. As the needs of the entity change, there is a good chance that the procurement policy is adjusted to meet those new circumstances. Sarpong et al., (2017) avows that this is necessary to make sure the policy continues to function in the best interests of the company or non-profit organization and keep the acquisition process simple and orderly.

Public procurement can be described as the procurement of goods and services on behalf of a public authority. It is funded by the taxpayers' money and as a result, there is a need to create the best value for the taxpayers' money (Van Weele, 2017). It is the process whereby public sector entities acquire goods, services and works from third parties of routine items to complex expenditures (Dzuke & Naude, 2017). Uyarra, Edler, Garcia-Estevez, Georghiou & Yeow (2014) opine that globally, public procurement plays a key role in service delivery and the performance of public entities.

Public procurement constitutes 18.42% of the world's gross domestic product. Botlhale (2017), remarks that public procurement accounts for a significant share of government annual expenditures globally, with governments spending approximately $11 trillion per annum on public procurement. In developing countries, it is estimated that procurement amounts to approximately 25% of the gross domestic product. Consequently, public procurement is of great importance to the economy of a country. Public procurement is a regulated, open process defined and controlled by numerous laws, rules, and regulations (Chigudu, 2014). It has its origins in the fiduciary obligation to deliver goods and services to the residents of a particular country and addresses a wide range of objectives.

For one, it has been used by governments to achieve socio-economic objectives such as stimulating economic activity, protecting industries from foreign competition and improving the competitiveness of certain industrial sectors (Ambe & Badenhorst-Weiss, 2012). Various scholars such as Uyarra et al., (2014) and Dzuke and Naude (2017) identified the following key problems in the public procurement system: (i) weak and outdated procurement policies and processes, (ii) public sector procurement remaining an operational activity and not a strategic activity, (iii) a lack of accountability and transparency; a lack of procurement knowledge and skill, (iv) embedded fraud and corruption and (v) the inability to implement appropriate reforms. Chigudu (2014) observed that the lack of appropriate skills and specialized knowledge are significant problems in public procurement, as procurement officers are required to provide value for money and interpret strategic considerations.

Equally observed that political interference in the procurement process is a problem to the successful implementation of public procurement in Africa as in most African countries, politicians influence the tender process, insisting that particular contracts are awarded to individuals or companies of their choosing. In sub-Saharan Africa, Ringwald & Ndercaj (2014) identified the following common problems affecting public sector procurement: (i) the lack of transparency, accountability and integrity in policy and process, (ii) the lack of professional, managerial and leadership skills, (iii) The lack of strategic recognition for the procurement function, (iv) the continued failure to implement appropriate change and (v) weak and outdated procurement policies and processes.

Dzuke & Naude (2017) attribute poor service delivery in Zimbabwe to problems in the procurement process. These problems include stock shortages of essential goods such as medicines, and also the poor quality of procured goods, and are attributed to a lack of proper procurement planning, cumbersome procurement processes, as well as ignorance of procurement processes, procurement policies and legislation. This study also alluded that that the requirements of the legal framework is a major challenge which is mainly caused by the fact that every stage and activity of the process is regulated and is exacerbated by the requirement that all activities, such as approval of tender documents and adverts, tender closing as well as evaluation, must involve the SPB.

According to the (GoK) Kenya Gazette Supplement No. 92, (2006), there are five types of public procurements; open tenders, where prospective suppliers are invited to compete for a contract advertised in the press and the lowest tender in terms of price is generally accepted although the advertisers usually state that they are not bound to accept the lowest or any tender. Brito, Brito & Hashiba (2014) avers another type of tender is the restricted open tender where prospective suppliers are invited to compete for a contract, the advertising of which is restricted to appropriate local newspapers. Selective tenders are those where tenders are invited from suppliers from an approved list that has been previously vetted regarding their competence and financial standing. In a negotiated tender, a tender is negotiated with only one supplier such that competition is eliminated. Procurement planning is another major requirement by both public and private organizations.

Ambe & Badenhorst-Weiss (2012) denotes that procurement planning is the process used by universities to plan purchasing activity for a specific period of time. This is commonly completed during the budgeting process. Each year departments are required to request a budget for staff, expenses, and purchases. This is the first step in the procurement planning process. Budgets for all departments are reviewed as committed to procurement planning, as the accountants spend time to find common purchasing requirements. Based on the budgets submitted, they may direct departments to work with central purchasing to combine their planned spending for specific commodities.

Gikonyo (2014) established that procurement planning plays a key role in the adoption of the budgetary process. A descriptive research design was used for the study. Data were sourced from procurement officers and general managers working with SACCOS societies which have FOSA, using a stratified random sampling technique a sample of 20% which makes a sample size of 86 respondents were used for the analyses. Quantitative data collected was analyzed by the use of descriptive statistics using SPSS and presented through percentages, means, standard deviations, and frequencies. The findings revealed that 55% of the respondent believed that the impact of the regulator on SACCO is high. The findings reveal that on the issue of the SACCO, culture favor's good procurement procedures, 53% of the respondent strongly agree. It was therefore recommended, that the Procurement process should uphold the integrity and ensure that there are no malpractices and there is informed decision-making, which requires public bodies to base decisions on accurate information and ensures that requirements are being met.

Brahim, Abada & Muhindo (2014) avers that the planning of purchases is no less important in universities and government than it is in industrial organizations. All public essential goods and services are required around the clock basis and government ability to deliver them and can be severely crippled by a shortage of needed goods or services. Brahim Abada & Muhindo (2014) opine that some services may be needed infrequently but if and when the institution or government must provide them. Methods and strategies commonly used by universities and governments to plan purchases more effectively include consolidation of requirements, term contracting, the delegation of purchasing authority and value analysis. In the consolidation of the requirements internally and sometimes with other entities, the government increase their buying power and thus obtain better pricing and services. Prior studies on compliance with public procurement regulations are done in developed counties. Jaafar, Ramli & Aziz (2014) in their study in Malaysia revealed that perceived inefficiency of the procurement policies was found an insignificantly negative impact on procurement compliance. Some of the most widely used criteria in supplier selection are supplier's capacity, quality, and purchasing price. However, the set of criteria to be chosen largely depends on the organization's objectives and the type of industry in which the organization competes.

2.3.6 Supply Chain Process Integration Capabilities, Information Technology Infrastructure, Government Policy and Supply Chain Performance

Researchers have a consensus that when different propositions related to organizations are aligned they enable organizations to achieve desired organizational outcomes. Thus for process integration to succeed there is a need to achieve a fit or match between supply chain process integration capabilities and information technology infrastructure to support

groundbreaking efforts that are critical to augment the competitiveness and performance of an organization. Many research articles have clearly argued and have provided evidence concerning the positive impacts of SCI on performance either through explicit or implicit consideration (Pierre et al., 2015). RBV has suggested that unique deployment patterns of unique resources and capabilities, is the basis on which competitive advantage of a certain firm is built and can be a primary determinant of superior performance. The resources and capabilities of an organization can be thought of as a platform from which the firm develops different products for several markets that enable the firm to develop competitively. This emphasizes is on a firm's basic capability, which includes the coordination of different types of product knowledge and the capability of integrating multiple technological flows (Rajapathirana & Hui, 2018).

Previous studies have investigated the influence of SCPI, information technology infrastructure, and government policy, as a single variable on the performance of organizations performance. These studies did not focus on the joint effect of the variables on supply chain performance. This study advanced a cohesive model to scrutinize the joint effect SCPI, information technology infrastructure, and government policy, on supply chain performance to depict a more comprehensive representation of the associations amongst the variables.

A balanced scorecard (BSC) outlines key performance indicators (KPIs) as sets of measures on aspects that are most critical to current and future success of an organization where competitive advantage over competitors may be built (Srivastava & Maitra, 2016). They comprise of financial, internal processes, innovation, improvement, and customers.

Montero et al., (2018) also divided it into cost and the non-cost, or qualitative and quantitative constructs. Qualitative measures can be customer satisfaction, flexibility, information, and material flow integration, effective risk management, supplier performance. BSC distinguishes indicators according to the level of the decision-making process: strategic, tactical, and operational. The customer and financial perspective is the way the company appears to the customers and the stakeholders whereas the internal business processes and learning and growth perspective is the way the company appears to the internal employees and managers (Pietrzak, Paliszkiewicz & Klepacki, 2015). Key performance indicators are suggested by scholars as being able to provide snapshot of an organization without wasting much time on volumes of information, provide information that is high-level and critical to decision making and also provide a set of competitive advantages in analysis where the results can be comparable to those in other organizations (Montero et al., 2018).

The CUC report (2006) advanced 10 high-level KPIs in the measurement of institutional performance from a perspective of governors in higher education, covering financial and non-financial aspects. Here, the focus is on the development and selection of KPIs for academic and management dimensions (Pietrzak, Paliszkiewicz & Klepacki, 2015). Although the use of KPIs has been a hot topic, little guidance or arguments on a concrete selection of KPIs among other performance indicators have been developed. One of the common criteria in selection may be critical and powerful to indicate the performance at their measurement. The selection procedures could be institutionally differentiated. The selection processes are very likely to be the result of managerial subjective judgments and may be driven by external stakeholders in universities.

A supply chain is part of the total product that must assure value for final customers. Chopra & Meindl (2016) defines the following flexibility dimensions: customer service flexibility which is the ability to accommodate special customer service requests; Order flexibility which is the ability to modify order size, volume or composition during logistics operation; Location flexibility which is the ability to service customers from alternative warehouse locations; and delivery time flexibility- the ability to accommodate delivery times for specific customers. Quality has always been one of the most important performance measures in purchasing. They tell you how well you are performing the activity- accuracy, including conformity with technical project specifications and sales leadership in presenting products with quality characteristics (Danese & Bortolotti, 2014). Three delivery dimensions suggested by Agus & Hajinoor (2012) include delivery speed, product lead time and product reliability hence the ability to reduce the time between order receipt and customer delivery to as close to zero as possible leads to customer satisfaction.

A study by Asgari, Hamid & Aleebrahim (2017) established that both perceived business customer's power and market-oriented culture significantly yields a focal firm's SCPI capabilities. Moreover, the result showed that the effect of the focal firm's market-oriented culture on SCPI capabilities is greater than the effect of perceived business customer's power on it. Such result was consistent with Yu, Jacobs, Salisbury & Harvey (2013) reasoning that governance mechanisms such as power (authoritative) or trust (normative) could encourage investment in and provide conditions facilitating the generation of creative approaches for dealing with business processes or activities in inter-organizational as buyer-supplier relationships.

2.4 Summary of Literature and Research Gaps

Most of the reviewed literatures aver that integrative practices positively contribute to supply chain performance (Gunasekaran, Subramanian & Rahman, 2015). Whereas the empirical literature evidence seems to be overwhelming, a part of the literature doubts the results and approach taken in supply chain integration research. According to Jaiswal et al., (2018) there is a wide variety of supply chain management and integration definitions. The consistency of measures and constructs is still limited as well different aspects of integration are measured, without explicitly addressing such choices (Klimczak, Machowiak, Staniec & Shachmurove, 2017). Jaiswal et al., (2018) addressed integration and measure pattern of behavior and operational practices respectfully. Accordingly, it was established that there is a direct relationship between internal integration, business and operational performance and that customer integration directly relate to operational performance.

Although supplier integration does not relate directly to either type of performance, the integration of supplier and customer were related to operational performance and that internal and external influence each other along with performance (Gunasekaran Subramanian & Rahman, 2015). Klimczak et al., (2017) also established that most buyers and sellers recognize the need for collaboration as the best means of improving costs, quality, delivery time and other measures of performance though the partnership with suppliers and customer is problematic and difficult in terms of managing procurement cycles. Other factors which were mostly identified as frequently challenging were rising logistics cost, poor storage facilities, difficulty in drafting specifications for materials and product design related issued.

These challenges lead to increase in total supply chain costs, reducing profitability in the long run making it difficult to reap the benefits of effective supply chain management practice (Klimczak et al., 2017). It was further established that in small firms' efficient supply chain integration may play a more critical role for sustainable performance improvement while in large firms close interrelationship between the level of SCM practices and competition capability may have more significant effect on performance (Antwi et al., 2015).

Literature consistently suggests that supply chain innovation has become all the most important in today's competitive world and that trust and shared information is critical a factor in fostering commitment among supply chain partners (Jaiswal et al., 2018). He equally observes that two key parameters of business performance of efficiency and effectiveness apply to different organizational network contexts, including strategic alliances, joint ventures sourcing and outsourcing agreements.

Literature on supply chain collaborations (SCC) is very extensive in both business and academia, but not always on target, studies focus on the cultural aspects of collaboration, which is a serious oversight. While other studies established that the expectation of relation is important for motivating collaborations in inter-organizational relationships. They identify information sharing, joint decision making and incentive alignment as factors that facilitate collaborative action through information exchange between the buyer and supplier (Wagner & Bode, 2014). According to existent literature many government corporations lack effective procurement policies and that this greatly hampers effective execution of sustainable procurement practices (Ambe & Badenhorst-Weiss, 2012).

However, the study failed to suggest how organizations should design and implement effective procurement policies for supporting implementation of sustainable procurement practices. In Kenya, there seems to be lack of a specific study that highlights how public universities should improve on procurement policies in order to create a guiding framework for implementing effective procurement practices. The Public Procurement and Disposal Act (2005) seem to have failed to offer specific guidelines on how public universities should embrace efficient procurement policies. Equally other studies examined enforcement mechanisms to enhance compliance to public procurement regulations.

Most studies on compliance with public procurement regulations have been done in developed counties such as Malaysia by Jaafar, Ramli & Aziz (2014) who revealed that perceived inefficiency of the procurement policies was found insignificantly negative impact on procurement compliance. The studies failed to clearly demonstrate determinants that impact on compliance with procurement regulations in public sectors. The study contended that the lack of an entity that has oversight responsibilities creates serious gaps in the enforcement of rules and regulations. For example in Zimbabwe, the most difficult challenge to install such an oversight body was found to be the lack of political will at the highest levels of government to significantly overhaul the existing system and capacitate the Anti-Corruption Commission.

According to Zhang & Huo (2013) previous discussion of literature focused on the levels and components of supply chain integration. The detailed review of the supply chain integration literature showed that there is also inconsistency in the theoretical paradigms that underpinned the subject.

It further shows that there is variance in the theories used in most studies while some other studies did not ground supply chain integration in any theoretical paradigm (Chae, Olson & Sheu, 2014). Although this inconsistency is unsurprising as the field of supply chain management still lacks a theoretical underpinning (Krishnapriya & Baral, 2014). This thesis highlights this as one of the issues shaping the supply chain integration literature and that it is affecting the findings from empirical research. Therefore, the thesis argues that there is a need for more effort in grounding supply chain integration in theory and understanding this theory across the supply chain.

This thesis draws on the Resource Based View (RBV) for providing a theoretical foundation of the supply chain integration phenomenon and interpreting the empirical findings. RBV is applied across the three levels of both external (supplier and customer), and internal integration (Chae, Olson & Sheu, 2014). Although the original tenet of RBV theory is focused on the intra-firm level, the later extension to the theory in literature represented by introducing the Extended Resource Based View (ERBV) appeared to support the power of this theory in explaining the supply chain integration phenomenon. Previous literature (Krishnapriya & Baral, 2014) provided a useful application of RBV Theory to understand dyadic information sharing and inter-organizational relationships. The RBV theory has not previously been applied for explaining the supply chain integration phenomenon comprising internal company integration, external supplier and customer integration.

The literature review also showed that supply chain integration research needs to consider both new national and industry perspectives. Several authors agree that the role of national context in supply chain integration research is neglected (Kamal & Iran 2014). Thus, recent research called for studies on supply chain integration in different national contexts (Chul-hwan, 2018). Kamal & Iran (2014) suggested that there is a lack of studies on supply chain integration from different contexts and that most literature was conducted in a western culture setting. The other element of context is the product or industry of investigation. Recent research has called for studies on different product contexts to be considered in order to support the development of and our understanding of supply chain integration (Song, Feng & Jiang (2017). Zhang & Huo (2013) suggested the inconsistency of the levels and components of integration, this literature review proposed that the national and product contexts, theoretical foundation and validating data across the supply chain are also important factors that need to be considered in supply chain integration research.

The detailed literature review showed 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). However, most of these studies did not specify what levels of external integration are improved in the presence of internal company integration. In fact, 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). Therefore, recent literature called for the issue of interrelationship between the levels of integration to be considered in future research.

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. In addition, the moderating effects of market orientation on the relationship between supplies chain integration and firm performance. The study determined that operational coordination is positively associated with operational performance and business performance. Information sharing affects only operational performance; it has no impact on business performance. The results also provided empirical support for the moderating effects of market orientation on the association of supply chain integration and firm.

Yadav & Sharma, (2015) affirmed that different situations may trigger the need for supplier selection as for instance internal controls at an institution affect compliance with public procurement. This is very important especially where other alternative methods of procurement other than open tender system are applied. In view of the existent literature studies indicate that compliance with procurement regulations in public and private sectors has not been successful. The studies also fail to clearly demonstrate determinants that impact on compliance with procurement regulations in public sectors.

In Africa, studies such as Dzuke & Naude (2017) examined the level of compliance with the Public Procurement Act (Act663) in public sector in Zimbabwe and revealed that compliance with Public Procurement Act 2003 (Act 663) was faced by challenges. Ojo & Gbadabo (2014) study the assessment of non-compliance with procurement proceedures in procurement of works in Nigeria, using the mean score ranking they were able to establish areas and reasons for non-compliance. Significant bid open or evaluation and reporting, procurement procedure, and political party or authority influence of decisions are significant.

Song, Feng & Jiang (2017) examined the moderating roles of firm size on the relationships among green external integration, the time-to-market of environmentally friendly products and firm performance. Using data collected from 176 Chinese manufacturing companies, the findings indicated that firm size moderated three of the eight relationships. Equally the study established that the time-to-market environmentally friendly products mediated the relationships between green customer integration and operational performance for all the studied firms, while it mediated the relationships between green customer integration and business performance only for small and medium firms. In addition, the time-to-market of environmentally friendly products mediated the relationships between green supplier integration and operational performance for medium firms, while it mediated the relationships between green supplier integration and business performance for small and medium firms.

Vereecke & Muylle (2006) conducted a study to empirically test the relationship between supply chain (SC) collaboration and performance improvement. The researcher developed incorporating dimensions of supplier and customer collaboration and performance improvement. The study was conducted in the assembly industry and hence the findings cannot be generalized to public sector. In another study conducted by Barrat (2004) on understanding the meaning of collaboration in supply chain the author reviewed a number of literature on the elements of supply chain collaboration and their application and subsequent effect on business performance, the study did not show the influence of supply chain collaboration on performance, notwithstanding, it was limited to USA which is developed country hence its findings may not be generalized to Kenya.

Locally, few studies have been done focusing on determining factors that affect youth participation in public procurement (Harper, Ramirez & Ayala, 2016). Njagi & Ogutu (2014) investigated challenges of implementing procurement policies in State Corporations in Kenya. The study established that political interference, information technology, quality of personnel greatly undermine effective implementation of procurement policies in state corporations. Other local studies focus on determining challenges faced during implementation of procurement regulations in organizations. Njagi and Ogutu (2014) studied the impact of supply chain integration on supply chain performance in state corporations in Kenya. A census study was conducted where a total of fifteeen (15) corporations were studied in order to assess the level of upstream and downstream integration and the relationship between integration and performance of state corporations. The study findings revealed a positive and significant correlation between supply chain integration and performance of the state corporations studied in Kenya.

Table 2.1 provides a summary of the key studies which offered grounding for current study. The table outlines key details of the studies including title, methodology and also gives the knowledge gap.

Table 2.1: Table Summary of Empirical Literature and Knowledge Gaps

Study	Research Focus	Methodology	Key Findings	Knowledge Gaps	Focus of Current Study
Hefu Ke, Wei, & Hua (2016)	Supply Chain Integration, Market Orientation on Firm Performance	The study adopted A descriptive research design and hierarchical regression analysis.	Operational coordination relates to operational performance and business performance.	Study established business performance as well as operational performance effects of market orientation. Evidence from China	Focus was on supply chain performance and used ITI and government policy as mediating and moderating variables in public universities in Kenya
Zhang & Huo, (2012)	The impact of dependence and trust on supply chain integration, investigated the joint influence of dependence and trust in supply chain relationships on supply chain integration and financial performance.	Structural equation modeling from 617 manufacturers in China. Used survey data and Hierarchical regression analysis.	The study established that trust with customers/suppliers significantly influence supply chain integration. They also established that both supplier and customer integration significantly improved financial performance.	Study was inclined to manufacturing. Used joint influence of dependence and trust in SC relationships on SC integration. The study also used financial measures of performance. Did not examine the influence of moderating variables and intervening variables such government policy and ITI.	This study examined the joint effects of ITI and government policy on the relationship between SCPIC and supply chain performance of public universities in Kenya that used non-financial performance measures
Hatani (2017) .	The moderating effects of technological and demand uncertainties on the relationship between supply chain integration and customer delivery performance.	Used survey data and hierarchical regression analysis	Internal and supplier integration, Technological and demand uncertainties, internal integration and customer delivery performance, and supplier integration	The study used Technological and demand uncertainties as moderating variables. Financial measures of performance Different from the current study that examined the influence IT infrastructure as Intervening and government policy as moderating variables	study examined the influence IT infrastructure as Intervening and government policy as moderating variables on the relationship between supply chain process integration capabilities and SC performance of public universities in Kenya
Ageron et al. (2013)	Examined and evaluate the importance of IS/IT criterion in the procurement supplier selection process in French companies.	Exploratory research design. likert scale Technology Indicators: Quality, Flexibility, Intra- or Inter-organizational information system	The results suggest that IT/IS is a significant supplier selection criterion within supply chain context because of the rapid proliferation of information.	Having been conducted in France, the findings of this study cannot be generalized to Kenya. The study did not look at the influence of IT infrastructure on supply chain performance	Examine the SC process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya

Tiryakiog and Yulek (2015)	A selective literature survey of academic research and policy experience on public procurement policies utilized to foster technological development.	Descriptive research design, descriptive statistics and correlational analysis	Study established that some form of development based procurement policy was considered with most of the practical policy concentrates in military offsets	Study was in turkey and was limited to public procurement policies utilized to foster technological development. In Turkey	Examined moderating effects of government policy in the contexts of law and procurement procedures on the relationship between SCPIC and supply chain performance of public universities in Kenya
Duffy, Jeyaraj, Farmer and Sethi (2015)	Organizational Engagement with Supply Chain Integration.	Cross-sectional research design, descript statistics, multiple regression, step-wise regression analysis,	Business strategy aligned consistent to supply chain strategy leads to supply chain integration	Business strategy supply chain strategy supply chain integration, did not look at the influence of ITI on supply chain performance	SCPIC, ITI and government policy on SC performance of public universities in Kenya
Mikihisa, & Oji. (2017)	Success factors for continuous supply chain process improvement: Japanese manufacturers. Case studies of eight Japanese manufacturers	used descriptive statistics and financial performance measures	Planning of supply chain process improvement depends on the existing stage of the firm's supply chain Management reform. firms with high scores for supply chain process operation capabilities did not have supply chain performance systems	Japanese manufacturers, financial performances measurements. The study focused on supply chain process improvement factors. These firms were selected based on their supply chain process operation capabilities. Did not use ITI and government policy as mediating or moderating variables	Study examined influence of ITI and government policy in the relationship between supply chain process integration capabilities, on SC performance of public universities in Kenya. Used census, non-financial indicators and both descriptive and inferential statistics
Wong & Wong (2011)	The contingency effects of the environmental uncertainty on the relationship between supply chain integration and operational performance.	Multi-group and structural path analyses of survey from 151 of Thailand's automotive manufacturing plants.	The study findings revealed a positive relationship between supply chain integration dimensions and operational performance dimensions as well.	Study was inclined to manufacturing used moderating the contingency effects of environmental uncertainty. The study also used financial measures of performance. Did not examine the influence of moderating variables and intervening variables such government policy and ITI; used Financial measures of performance.	Examined moderating effect of government policy on the relationship between SCPIC and supply chain performance; and whether ITI mediates the effect of SCPIC on supply chain performance of public universities in Kenya; used non - financial measures of performance.
Jaafar, Ramli & Aziz (2014)	Roles of Compliance with Government Procurement Policy, Factors and Sustainable Public Procurement Practice.	Used cross-sectional time series and generalized Estimating equations approach.	Interaction between professionalism and level of compliance with the GPP, interaction between shariah ethics and level of compliance with	The study examined the role of compliance of government procurement policy as independent variable and specifically looked at Professionalism, Shariah ethics Malasya.	This study examine the moderating effects of Government policy on the relationship between supply chain process integration capabilities and SC performance of public universities in Kenya

Ojo & Gbadabo (2014)	Assessment of Non-Compliance with Procurement Proceedings in Procurement	Descriptive research design and descriptive statistics, mean score ranking and Correlation analysis	Familiarity of procurement rules and political influence on decision making	Non-Compliance with Procurement Proceedings in Procurement of Works in Nigeria	Effect of government policy on the relationship between supply chain process integration capabilities and SC performance
Song, Feng & Jiang (2017)	Examined the moderating roles of firm size on the relationships among green external integration, the time-to-market of environmentally friendly products and firm performance.	Descriptive survey data and hierarchical regression analysis 176 Chinese manufacturing companies.	Firm size moderates the relationship and time-to-market environmentally friendly products mediated the relationships between green customer integration and operational performance	Used moderating effect of firm size and time-to- market to mediate the relationship. Study was keen on green customer integration. Manufacturing sector. Used financial measures of performance of manufacturing companies in china context. Did not examine the influence of moderating variables and intervening variables such government policy and information technology infrastructure; used Financial measures of performance.	Examined moderating effect of government policy on the relationship between supply chain process integration capabilities and supply chain performance; and whether information technology mediates the effect of supply chain process integration capabilities on supply chain performance of public universities in Kenya; used non - financial measures of performance.
Dzuke,& Naude, (2017)	Problems in the different stages of the operational procurement proce ss in the public sector.	Descriptive research design and descriptive statistics	Majority factors advertising, bid evaluation and contract stages	Zimbabwean in public sector	Government policy on the relationship between SCPIC, ITI, SC performance of public universities in Kenya.
Chigudu (2014)	Public Procurement Issues and challenges', Public Procurement, Public Officials, Tender Procedures.	Descriptive research design and descriptive statistics	Procedures for personal gains. There is need for political will to enforce the law on errant behavior, No value for money &no mechanism for feedback to inform management and policy makers	Operating Environments in Zimbabwe:	Influence of GP on relationship between SCPI, Performance, IT Infrastructure mediates the effect of SCPIC and SC performance of public universities in Kenya.

Source: Researcher, (2018)

2.5 Conceptual Framework

Sekaran & Bougie (2016) describes conceptual framework as a graphical representation of the researcher's conceptualization of the relationships between variables in a study as well as a hypothesized model identifying the concepts or variables under study and showing their relationships.

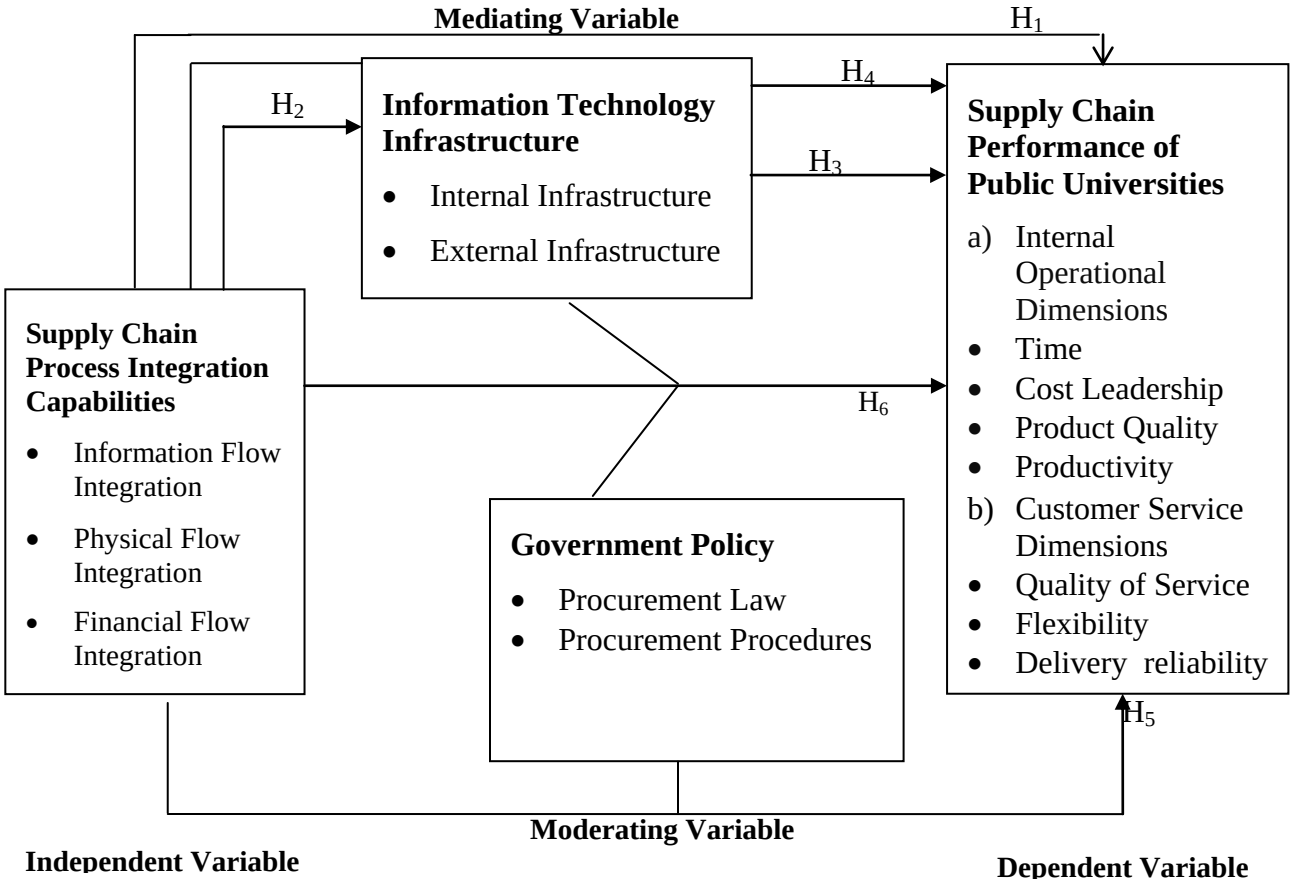
Kothari & Garg (2014) defines a variable as a measurable characteristic that assumes different values among units of specific population. This study categorized key variables as dependent and independent. Independent variables predict the amount of variation that occurs in another variable while dependent variable is a variable that is influenced by another variable (Saunders, Lewis & Thornhill, 2016).

This study integrated RBV, CNT, RDT and Agency theory to develop the framework for the study. According to the RBV unique deployment patterns of unique resources and capabilities is the basis on which competitive advantage of a certain firm is built and can be a primary determination of superior performance. RDT argue that 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 (Kito & New, 2015).

Collaborative network approach avers that firms have chosen a more integrative management style with a focus on collaborations along the supply chain as a whole in order to remain competitive abandoning the antagonistic approach (Aschhoff, 2018). While agency theory is about the principal-agent relationships that are enacted in a broader supply chain integration perspective for the implementation of policies geared towards aligning incentives so as to discourage self-seeking behavior and bounded rationality by agents hence reduce agency costs (Byrne & Power, 2014). In addition, the operational nature of supply chain expenditures decisions must be taken by the firm's management (agents) on behalf of the universities (principals) under the authority entrusted to them through employment.

The conceptual framework was adapted from; Bhatti (2016); Bhardwajb (2015); Soosay & Hyland (2015); Peng, Quan, Zhang & Dubinsky (2016); Deepak & Saji (2016); Tiwari, Tiwari & Samuel (2015); Sarpong, Du, Antwi, Boamah & Adeleke (2017); Matopoulos, Barros & Van der Vorst(2015); Jan, Olga & Aleksandra (2018) Kumar & Kushwaha, (2018); Bai and Sakaris (2014) which assisted in the operationalization of variables in Table 3.2. A conceptual model of the relationship between among supply chain process integration capabilities, information technology infrastructure, and government policy and supply chain performance proposed in this study is shown in Figure 2.1.

Figure 2.1: A Conceptual Model Depicting the Relationship between Supply Chain Process Integration Capabilities, Information Technology Infrastructure Government Policy and Supply Chain Performance of Public Universities



As shown in Figure 2.1 supply chain performance of public universities is the dependent variable, supply chain process integration capabilities is the independent variable, information technology infrastructure is the mediating variable and government policy is the moderating variable. The following section discusses the conceptualized relationships among the variables and the rationale for the expected relationship from which hypotheses were proposed for empirical testing.

2.5.1 Conceptual Hypotheses

The conceptual model (Figure 2.1) suggests that supply chain process integration capabilities were expected to have an effect on supply chain performance. RBV perceive that unique deployment patterns of unique resources and capabilities, is the basis on which competitive advantage of a certain firm is built and can be a primary determination of superior performance. There is consensus in the strategic management conversations on the role of firm resources and capabilities in explaining why firms differ in the creation and sustenance of competitive advantage (Matopoulos, Barros & Van der Vorst, 2015). They connote that resources are not valuable in themselves but because they allow firms to develop and implement value-creating strategies that create advantages in particular markets. Indeed, a firm that effectively uses its knowledge assets knows more about its customers, products, technologies, markets and their linkages. Thus, resources and capabilities can be thought of as a platform from which the firm derives various products for various markets that enable the firm to develop competitive advantage and improve its performance.

RBV scholars such as Chae, Olson & Sheu, (2014) theorized what; when a firm achieves competitive advantage and when the firms' resources are rare, valuable, or inimitable and non-substitutable. The focus is on how competitive advantage is generated, sustained over time within specific firms. Past studies (Lee, Chung, Lee, Gan & Chou, 2016; Hefu, Ke, Wei & Hua, 2016) reported positive relationship between information flow integration, physical flow integration and financial flows integration and supply chain performance. In view of these arguments and empirical evidence, the following hypothesis was proposed:

H_1 *Supply chain process integration capabilities have significant influence on supply chain performance of public universities in Kenya.*

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, Luo, Basnet, Ahn, Lee & Vossen (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, Tiwari & Samuel, (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 hypothesis was therefore proposed.

H_2 *Supply chain process integration capabilities have significant influence on information technology infrastructure in public universities in Kenya.*

Information technology infrastructure was expected to have a positive relationship with supply chain performance. There is evidence that internal integration in an organization is a prerequisite for successful supply chain management Otchere et al, 2013. As the competitive environment is becoming increasingly challenging, firms are undertaking efforts to compete along multiple fronts.

Organizations have turned to collaborate with their customers and suppliers to obtain information and complementary resources, which they can deploy to build competitive advantage. According to Govindan, Popiuc and Diabat (2013), inadequate investigation of internal and external coordinating mechanisms collectively amongst organizational and inter-organizational networks has been done. External cooperation amongst organizations may not provide significant performance improvements nor be successful without proper internal cooperation. It has been found that firms with well-developed internal and external interfaces perform better than their counterparts only with sound internal interfaces. In view of these arguments and empirical evidence, Tiwari, Tiwari & Samuel, (2015) affirm that IT infrastructure capability offers the appropriate support for process by providing the reach and connectivity to design and manage processes that connect the organization with its customers and suppliers. This enables organizations to design metrics and analytics to provide visibility into the real-time performance of various processes, the integration between the various processes and advance warnings about performance degradation in processes and finally a high level of information technology infrastructure capability that enables faster and more responsive redesign and reconfiguration of processes in responses to changes in business conditions. The following hypothesis was proposed in view of the literature:

H_3 *Information technology infrastructure has significant influence on supply chain performance of public universities in Kenya.*

Information technology infrastructure was expected to mediate the relationship between SCPIC and supply chain performances. Tina (2013) opines that the capability building processes and actions in firms tie information technology infrastructure capabilities with the development of customer management capability. Better information technology infrastructure capabilities enable firms to position their information technology 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. Resource combination results in better outcomes than those achieved by a single firm acting alone. CNT argue that the value of the resources can be expanded by its combination with other resources, then building effective inter-firm relationships within the network or supply chain can be more important than resource possessions per se (Festel, De Nardo & Simmen, 2014).

Past research provide a perspective that an integrated information technology infrastructure enables consistent and real-time transfer of information between supply chain management related applications and functions that are distributed across partners (Deepak & Saji, 2016; Scholten & Schilder, 2015). Supply chain integrative capabilities can improve corporate performance indirectly through higher information technology infrastructure's ability to innovate which in turn affects supply chain performance. Based on the literature, the following hypothesis was proposed:

H_4 *Information technology infrastructure has significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.*

The relationship between SCPIC and supply chain performance was also expected to be moderated by government policy. Agency Theory determines how procurement managers execute procurement practices on behalf of universities. Existence of poor principle-agent relationship leads to low level of top management commitment and this also affects the relationship between universities and the suppliers. The existence of conflict of interest amongst the agents leads to execution of procurement practices against the procurement policies and this leads to increased procurement budget and loss of procurement funds. According to Sarpong, Du, Antwi, Boamah & Adeleke (2017) implementing an efficient procurement system improves organizational performance and nationally improve policy formulation and decision-makers understand the interactions of the various policy goals and the impact of the policy on overall performance of the system. Decision makers can make improved and informed decision, create stronger incentives on governments to improve their public procurement systems, help them to set priorities for reform actions in the area of public procurement and to monitor, evaluate and review public expenditure system. The following hypothesis was proposed in view if these arguments.

H_5 *Government policy has significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.*

The variables of SCPIC, information technology infrastructure, and government policy were jointly expected to have a greater effect on supply chain performance than the effect of individual variables on supply chain performance.

Based on the Resource Based View, Collaborative Network Theory, Agency Theory and Resource Dependency Theory, it was expected that the relationship between SCPIC and supply chain performance was to be influenced by turbulent and dynamisms in organizational environments. Researchers have a consensus that when different propositions related to organizations are aligned they enable organizations to achieve desired organizational outcomes. Thus for process integration to succeed there is need to achieve a fit or match between supply chain process integration capabilities and information technology infrastructure to support groundbreaking efforts that are critical to augment the competiveness and performance of an organization. Many research articles have clearly argued and have provided evidence concerning the positive impacts of SCI on performance either through explicit or implicit consideration (Pierre et al., 2015).

The present study argued that supply chain performance is enhanced when organizational processes and systems are developed, implemented and aligned to supportive strategies such as applicable legislative requirements, internal departmental policies and information technology infrastructures. Hence the following hypothesis was proposed:

H_6 *The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is different from their individual effects.*

2.6 Summary of Chapter

This chapter discussed the theoretical perspective of the study and reviewed theoretical arguments and empirical studies on the linkages between the study variables of supply chain process integration capabilities, information technology infrastructure, government policy, and supply chain performance of public universities in Kenya.

The chapter also discussed the knowledge gaps and the focus of this study. Based on the literature, the chapter described the conceptual framework and formulated conceptual hypotheses of the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter describes the methodology that was adopted in conducting the study. It explains the philosophical orientation, research design and population of the study. It also describes data collection, operationalization of variables, tests of reliability, validity, regression assumptions and statistical techniques used to summarize data and test hypotheses.

3.2 Philosophical Orientation

There are two distinct positions regarding the approach to scientific inquiry these are positivism and phenomenologist. This study adopted positivism research philosophy which reflects the belief that reality is stable. This reality can be observed and described from an objective viewpoint without necessarily interfering with the phenomenon itself (Hyett, Kenny & Dickson-Swift, 2014). Positivists' belief that the hypothesis developed from existing theories can be tested by measuring observable social realities, thus positivism is derived from natural sciences. Based on previously observed, explained realities and their interrelationships, it is then possible under positivism research philosophy to make predictions. Rahman (2017) asserts that positivism research philosophy can be used to investigate what truly happens in organizations through scientific measurement of people and system behaviors hence this research philosophy can be used to investigate the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya.

This study adopted a positivist orientation because it was theory-driven and tested hypotheses which are the cornerstones of the positivist philosophy (Hyett, Kenny & Dickson-Swift, 2014). The choice of the research philosophy is based on the hypothesis that the researcher intends to test. Under positivism, it is possible to test the hypothesis and generalize the findings (Halfpenny, 2015). The researcher assumed an uninterested stance and objectivity in data collection and analysis. Cooper & Schindler (2014) asserts that the role of the researcher is limited to data collection and interpretation through an objective approach with research findings always quantifiable and observable. Therefore, a quantitative approach was essentially used. This approach is strongly linked to deductive testing of theories through hypotheses, while a qualitative approach to research normally is concerned with inductive testing (Kothari & Garg, 2014). Besides, the study was anchored on Resource-Based View, Agency Theory, Resource Dependency Theory and Collaborative Network Theory which facilitated postulation of the relationships between supply chain process integration capabilities, information technology infrastructure, government policy, and supply chain performance of public universities. In adopting a positivist methodology, it was presumed that the research models are phenomena with known dimensions and are quantifiable with standard instruments.

3.3 Research Design

Almalki (2016) states that research design is the way a study is planned and conducted. It also means the procedures and techniques employed to answer research questions. A research design entails choosing subjects to participate in the study and the techniques, approaches, and procedures for collecting data from the subjects.

Kothari & Garg (2014) assert that research design is a program that guides the investigator in collecting, analyzing and interpreting data. Some scholars such as Sekaran & Bougie, (2016) have argued that research design is a logical model of proof that allows the researcher to draw inferences concerning causal relationships among variables under investigation. There are various research designs classified based on various perspectives. The common perspectives on which research designs are classified are objectives of the study (descriptive or causal), the technique used for data collection (survey or experiment) and the time horizon of the study (cross-sectional or longitudinal). The availability of sources of data, the urgency of the decision and the cost of obtaining the data determine the design technique selected (Saunders, Lewis & Thornhill, 2016). The research design should provide confidence to the scientific fraternity that the findings derived from following the design capture the validity and possess high levels of reliability (Saunders, Lewis & Thornhill, 2016). Essentially the research design outlines the possible conclusions that the investigator can reach by specifically suggesting the statistical tests that can be made (Sekaran & Bougie, 2016). This study, therefore, argued that a research design is a logical strategy for planning research procedures and providing evidence for the development of knowledge.

The study adopted a descriptive, cross-sectional survey research design. A cross-sectional survey design entails the collection of data across many research units at one point in time predominantly by questionnaire (Gujarati, Porter & Gunasekarar 2013). In other words, data on the research variables were collected at a single point in time from sample units to examine potential relationships among the variables.

A cross-sectional survey was considered appropriate because of the need to collect data from a cross-section of the population at and the results generalized to represent the entire population of the study. The purpose of the survey is to obtain information that describes the existing phenomena and explain the existing status of the variables. The survey design was appropriate because of the purpose of the study, topical scope, and study involvement, time over which data was collected, nature of data collected and the type of analysis to be performed. The design also has enough provision for the protection of bias and maximized reliability (Kothari & Garg, 2014). The topical scope for this study was breadth and depth. Given this fact, the descriptive survey provided the opportunity to capture the population's features and test hypotheses quantitatively. Tiryakioğlu & Yülek, (2015) carried out a selective literature survey of academic research and policy experience on public procurement policies utilized to foster technological development using descriptive research design, descriptive statistics, and correlational analysis. Njagi & Ogutu (2014) used a descriptive survey design to assess the impact of supply chain integration on supply chain performance in State Corporations in Kenya.

3.4 Study Population

Population is the entire set of units for which the study data are to be used to make inferences (Kothari & Garg 2014). According to Cooper & Schindler (2014) it is the entire set of individuals (or objects) having some common characteristics as defined by the criteria established for the study. Target population is any group of individuals or subjects who have one or more characteristics in common that are of interest to all studies (Sekaran & Bougie, 2016). According to Gujarati, Porter & Gunasekarar (2013) all possible elements or units in the target population must be identified.

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.

Table 3.1: Target Population

Name University	SC	ICT
The University of Nairobi	1	1
Technical University of Kenya	1	1
Dedan Kimathi University of Technology	1	1
Multimedia University of Kenya	1	1
University of Eldoret	1	1
Meru University of Science and Technology	1	1
South Eastern Kenya University	1	1
Karatina University	1	1
Murang'a University of Technology	1	1
Kenyatta University	1	1
Egerton University	1	1
Moi University	1	1
Maseno University	1	1
Jomo Kenyatta University of Agriculture and Technology	1	1
Masinde Muliro University of Science and Technology	1	1
Laikipia University	1	1
Technical University of Mombasa	1	1
Jaramogi Oginga Odinga University	1	1
The Co - Operative University of Kenya	1	1
Rongo University	1	1
Kisii University	1	1
Kibabii University	1	1
Chuka University	1	1
Kirinyaga University	1	1
Machakos University	1	1
Pwani University	1	1
Taita Taveta University	1	1
University of Embu	1	1
Garissa University College	1	1
Maasai Mara University	1	1
University of Kabianga	1	1
Total	**31**	**31**

Source: Research Data 2018

3.5 Data Collection Tools and Technique

The study adopted a census technique for the unit of analysis which was 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. Census is unique in that it provides the possibility of examining an entire unit of study. The census approach is justified since according to Saunders, Lewis, & Thornhill, (2016) data gathered using census contributes towards the gathering of unbiased data representing all individuals' opinions in the study population on a study problem. According to Liu, Hub, Zhanc, Sun, Murch & Ma, (2018), the results obtained from a census approach are more representative, accurate and reliable. Thus, the census ensured the study generalized research findings appropriately. Census provides a true measure of the population since there is no sampling error and more detailed information about the study problem within the population is likely to be gathered (Sekaran & Bougie, 2016).

3.6 Data Collection Procedure

Research data can be obtained from primary or secondary sources (Sekaran & Bougie, 2016). To achieve the objectives of the study primary data was used. The questionnaire was the main instrument for data collection. Questionnaires have the advantage of obtaining data more efficiently in terms of time, energy and costs (Sekaran & Bougie, 2016). The questionnaire for this study was developed to measure the respondents' perceptions of the existence and magnitude of the research variables: Supply chain process integration capabilities, information technology infrastructure government policy, and supply chain performance of public universities.

Designing a sound questionnaire requires a focus on three main issues. These include simple wording of questions, planning of how the variables will be categorized, scaled and coded, and general appearance of the questions. These issues were addressed to minimize bias in the study.

This study used closed-ended questions that have the advantage of helping the respondents make quick decisions to choose among the set of alternatives. Closed questions also make it easier to code the information for subsequent analysis (Sekaran & Bougie, 2016). The study used a 5-point Likert type scale method of summated ratings where respondents were asked to record their opinion ranging from strongly agree to strongly disagree; Strongly agree represented 5 while strongly disagree represented 1 on the Likert type scale. According to Sekaran & Bougie (2014), Likert type scale is essentially an interval scale designed to examine how strongly subjects agree or disagree with a statement. This scale was suitable for the study because it provided an interval or ratio based scale and is the most powerful scale for statistical analysis. Kothari & Graig (2014) posit that 5-point Likert type scales are used because they are more reliable and can provide more information. Likert type scaling is a unidimensional scaling method whose concepts are generally easier to understand.

The participants were asked to either agree or disagree with the statements using a 5-point Likert type scale where 1=strongly disagree; 5=strongly agree. Blome et al. (2014) in their study on supply chain collaboration and sustainability: a profile deviation analysis used a 5-point Likert type scale. While Vurro et al. (2014) asked respondents to rate each item on a 5-point Likert type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

The questionnaire for this study presented in Appendix I was arranged in five sections. Section I had questions on the respondent. Section II contained questions on the profile of the universities. Section III contained questions about supply chain process integration, divided into subsections of information flow integration, physical flow integration, and financial flow integration. Section IV contained questions regarding information technology infrastructure divided into two parts covering dimensions of internal integration and external integration. Section IV contained questions on government policy with public procurement law and procurement procedures. Finally, Section V contained questions on the supply chain performance of public universities.

3.6.1 Research Questionnaire

The main data collection instrument was a questionnaire containing closed-ended questions with the quantitative section of the instrument utilizing an ordinal scale format. The ordinal format was selected because according to Sekaran & Bougie (2016) the format yields equal-interval data, a fact that allows for the use of more powerful statistical tools to test research variables. Questionnaires are preferred because according to Saunders, Lewis & Thornhill, (2016) they are effective data collection instruments that allow respondents to give much of their opinions about the researched problem. According to Kothari & Garg (2014), the information obtained from questionnaires is free from bias and researchers' influence and thus accurate and valid data was gathered. All the respondents in this study were literate and filled the questionnaires on their own without the physical presence of the researcher hence offering a great assurance of anonymity and systematically generated detailed data on the study indicators.

3.6.2 Primary Data

Cooper & Schindler (2014) aver that open-ended and closed-ended questionnaires, interview schedule and content analysis are common instruments of data collection. Interviews range from the highly structured style in which questions are determined before the interview to the open-ended and conversational format. In qualitative research, the highly structured format is used primarily to gather socio-demographic information. For the most part, however, interviews are more open-ended and less structured. Frequently, the interviewer will ask the same questions to all the participants but the order of the questions, wording and the type of follow-up questions may vary considerably.

Observation in qualitative research generally involves spending a prolonged amount of time in the setting. Field notes are taken throughout the observations and are focused on what is seen. A structured questionnaire was used to collect data on the effects of SCPIC on the supply chain performance of public universities in Kenya. The open-ended questions were used to get views on a given phenomenon and were filled by the respondents whereas closed-ended questionnaires are meant to provide a clear analysis of the scenario. A structured questionnaire ensured collecting standardized data which in turn results in easy comparison findings and also allowed researchers to obtain information that cannot be observed directly.

3.6.3 Data Collection Procedure

The researcher obtained an introduction letter from the Technical University of Kenya and a research permit from the National Council for Science, Technology, and Innovation (NACOSTI).

Permission to collect data was also sought from the administrations of the 31 public universities. This was followed by the recruitment of research assistants. The researcher and the research assistants used to drop and pick method in the data collection. The respondents were given a maximum of a week after which the questionnaires were collected. The drop and pick method were appropriate considering the availability of the respondents and the geographical dispersion of the target population of the study. The reason why the questionnaires were self-administered and collected in person was that the mail survey has been criticized for non-response bias. If persons who respond differ significantly from those who do not, then, the results may not allow one to say how the whole sample would have responded (Armstrong & Overton, 1977). The survey took five months from October 2017 to February 2018.

3.7 Operationalization of Key Variables

The survey contained several measures designed to elicit information about the research variables. Sekaran & Bougie (2016) posit that a concept must be made operational to render it measurable. This is done by looking at the dimensions, facets or properties denoted by the concept which are then translated into observable and measurable elements on which measurement scale is developed. The key constructs used in the study were classified: Supply Chain Process Integration Capabilities (SCPIC) dimensions- (Information flow integration, physical flow integration, and financial flow integration) were categorized as the independent variable. Information Technology Infrastructure (ITI) dimensions- (internal infrastructure and external infrastructure) was classified as the mediating variable.

Government policy had two dimensions (procurement law and procurement procedures) classified as the moderating variable. Supply chain performance of public universities; Internal operational dimensions (Time, cost leadership, product quality, and productivity), customer service dimensions (quality of service, flexibility, and delivery reliability) was classified as the dependent variable. This action was followed by the identification of suitable questionnaire items from the existing literature. Lastly the nature of the scale (i.e. scale, ordinal, nominal) was also a key consideration in selecting the studies from which questionnaire items were adapted (Saunders et al., 2016). The 5 point Likert type scale intervals used in previous studies were retained rather than changing them). The operationalization of variables as indicated in Table 3.2 begins from 8.0 to 18.0 indicating the variable, indicators, measure, and literature instrument and question number.

Table 3.2: Operationalization of Variables

Variable		Operationalization (Indicators)			
Supply Chain Process Integration Capabilities	**8.0**	**Information flow integration**	**Measure**	**Literature**	**Instrument and Question No.**
	8.1	Our university shares its business unit's propriety information with its supply chain partners.	Five type Likert scale	Bhatti (2016)	Questionnaire Section C: 8.1-8.5
	8.2	Our university shares information with its supply chain partners in advance of changing needs.		Bhardwajb (2015)	
	8.3	Our university and its partners exchange information that helps establishment of business planning.			
	8.4	Information exchange between our university and its supply chain partners is timely, adequate, complete, and reliable.			
	8.5	Our supply chain partners are actively involved in standardizing Supply chain practices.			
	9.0	**Physical flow integration**	**Measure**	**Literature**	**Instrument and Question No.**
	9.1	Movement of goods from source to customer influence supply chain integration.	Five type Likert scale	Soosay & Hyland (2015)	Questionnaire Section C: 9.1-9.7
	9.2	Integration of systems with supplier's influence supply chain integration.			
	9.3	My university has an inventory management system integrated with our suppliers.			
	9.4	My university has supplier relationship management systems.			
	9.5	My university has customer relationship management systems.			
	9.6	My university has decision support management systems.			
	9.7	Supply chain process integration influences Information Technology (IT) infrastructure.			
	10.0	**Financial flow integration**	**Measure**	**Literature**	**Instrument and Question No.**
	10.1	Integration facilitates the flow of funds in my university	Five type Likert scale		Questionnaire Section C: 10.1-10.4
	10.2	My university applies e- invoicing			
	10.3	My university applies e- payments			
	10.4	Internal transfers are applied in my university			
Information Technology	**11.0**	**Internal infrastructure**	**Measure**	**Literature**	**Instrument and Question No.**

Infrastructure	11.1 11.2 11.3 11.4 11.5 11.6 11.7 11.8 11.9 11.10 11.11 11.12	Through ICT my university shares a sense of fair play with its customers. Through ICT my university frequently interacts with customers to set its reliability responsiveness and other standards. Through ICT my university frequently follows our customers for quality service feedback Through ICT my university frequently determines future customer expectations. Through ICT my university facilitates customers' ability to seek assistance from it. Through ICT my university periodically evaluates the formal and informal complaints of its customers. Through ICT my university periodically evaluates the importance of its relationship with its Customers. Through ICT my university contributes to the efficiency and effectiveness of our business processes. Through ICT my university enables university to break time barriers. Through ICT my university enables university to break cost barriers. Through ICT my university enables value addition to product/services. Through ICT my university provides rich data about customers and competitor.	Five Likert scale	Peng, Quan, Zhang & Dubinsky (2016) Deepak & Saji (2016)	Questionnaire Section D: 11.1-11.12
	12.0	**External infrastructure**	**Measure**	**Literature**	**Instrument and Question No.**
	12.1 12.2 12.3	Through ICT my university shares a sense of fair play with its customers Through ICT my university frequently interacts with customers to set its reliability responsiveness and other standards Through ICT my university frequently follows our customers for quality service feedback	Five type Likert scale	Tiwari, Tiwari & Samuel (2015)	Questionnaire Section D:12.1-12.10
	12.4 12.5 12.6 12.7 12.8 12.9 12.10	Through ICT my university can easily build and alter our information linkages to our existing supply chain partners (e.g. customers, suppliers and third-party logistics providers in response to changes in the business environment) Through ICT we can easily build and alter our information linkages to new supply chain partners Through ICT my university strives to establish long-term relationship with suppliers Through ICT my university includes key suppliers in its planning and goal setting Through ICT my university actively involves its key suppliers in new product development Through ICT my university includes key suppliers in its planning and goal setting. Through ICT my university actively involves its key suppliers in new product development		Hall, Algiers & Levitt (2018)	
Government Policy	**13.0**	**Procurement law**	**Measure**	**Literature**	**Instrument and Question No.**

	13.1 13.2 13.3 13.4	In my university public procurement policy enables public private partnership procurement. Public Procurement allows my university to do joint procurements with other universities In my university public procurement enables collaborations with other universities. In my university we comply with Public Procurement Act to the letter.	Five type Likert scale	Sarpong, Du, Antwi, Boamah & Adeleke (2017)	Questionnaire Section E: 13.1-13.4
	14.0	**Procurement procedures**	**Measure**	**Literature**	**Instrument and Question No.**
	14.1 14.2 14.3 14.4	In my university public procurement procedures in terms of acquiring goods, service and works are satisfactory. In my university consider public procurement procedures in terms of asset disposal are satisfactory. In my university public procurement enables collaborations with other universities. In my university open tendering is the most common method used for procuring.	Five Likert scale	Sandru (2017) Chigudu (2014)	Questionnaire Section E: 14.1-14.4
Supply Chain Performance of Public Universities in Kenya	**15.0**	**Internal operational dimensions** **Process Flexibility**	**Measure**	**Literature**	**Instrument and Question No.**
	15.1 15.2 15.3 15.4	My university has the ability to respond to and accommodate demand variations. My university has the ability to respond to and accommodate the periods of poor supplier performance. My university has the ability to respond and accommodate periods of poor delivery performance. My university has the ability to respond and accommodate new products, new markets or new competition.	Five type Likert scale	Bai and Sakaris (2014)	Questionnaire Section F: 15.1-15.4
	16.0	**Cost leadership**	**Measure**	**Literature**	**Instrument and Question No.**
	16.1 16.2 16.3 16.4 16.5 16.6	My university optimizes on total costs associated with delivery, return on investments. My university produces materials, components, and products at low cost. Our universities' strategy on cost leadership has reduced our production cost. Our universities' strategy on leadership has reduced our inventory cost. Our universities' integration strategy on cost leadership has reduced our unit cost. Our universities' strategy on cost leadership has increased our labor productivity.	Five type Likert scale	Matopoulos, Barros & Van der Vorst (2015)	Questionnaire Section F: 16.1-16.6
	17.0	**Delivery reliability**	**Measure**	**Literature**	**Instrument and Question No.**
	17.1 17.2 17.3 17.4	Supply chain integration allows my university to facilitate time breaks. Supply chain integration allows my university to facilitate real-time deliveries. Provide materials/components/products that are highly reliable. The university supply chain integration	Five type Likert scale	Kumar & Kushwaha (2018)	Questionnaire Section F: 17.1-17.7

		strategy has enabled faster deliveries to our customers.			
	17.5	The university supply chain integration strategy has enabled on-time deliveries.			
	17.6	The university supply chain integration strategy enabled reliable deliveries.			
	17.7	The university supply chain integration strategy has led to a decrease in the lead time.			
	18.0	**Customer service dimension**	**Measure**	**Literature**	**Instrument and Question No.**
	18.1	There is improvement in terms of speed of operations in my university due to supply chain process integration.	Five type Likert scale	Jan, Olga & Aleksandra (2018)	Questionnaire Section F: 18.1-18.4
	18.2	My university's level of service provided to customers has improved.			
	18.3	There is improvement in terms of quality of service/product in my university due to supply chain process integration.			
	18.4	There is improvement in the quality of service/products to our customers due to supply chain process integration.			

3.8 Pilot Study

Abdolshah, (2013) avers that before embarking on the final study, it is necessary to conduct a pilot study to determine the clarity, reliability, and validity of the instrument. A pilot study was carried out to enable the researcher to assess the clarity of the instrument and its ease of use. According to Gujarati, Porter & Gunasekarar (2013), pre-testing allows errors to be discovered before the actual collection of data begins. Research should be based on absolutely correct, defect-less and errorless measuring instruments, tools or procedures of measurement. For this study, the acceptability of a measuring instrument was tested on the principles of adherence to the standards of perfect reliability, confirmed practicability and verified validity. Practicability is concerned with a wide range of factors of economy, convenience, and interpretability (Kothari & Garg 2014). A pilot survey is meant to eliminate, in advance, some of the problems that are likely to be encountered during the final survey (Sekaran & Bougie, 2016).

Henry, Rado & Scarlett (2012) conducted a pilot test to evaluate the questionnaire developed to find out if potential inconsistencies or errors existed or questions that needed clarifications to improve the research instrument. In this study pretesting involved 5 respondents translating to 16% of the target population. According to Abdolshah, (2013) 10% of the sample required for a full study should be used in a pilot study.

The respondents in the pilot study were asked to make comments and suggestions regarding the instructions and clarity of the questions asked. The pre-tests raised no concerns as respondents had no problem understanding and answering the questions. The respondents were the heads of Procurement and ICT. The heads were targeted since they are the ones involved in the execution of key supply chain management decisions and hence have technical knowledge and skills on the effects of supply chain process integration, information technology infrastructure, government policy on public universities' performance.

3.8.1 Validity and Reliability Testing

Validity and reliability are two essential characteristics of a good measurement tool (Gujarati, Porter & Gunasekar, 2013). The measurement tools used to measure research variables must be reliable and valid to yield accurate results. Validity and reliability are related and reliability is necessary but not sufficient condition for validity. In other words, a reliable instrument may not be valid, but for a test to be valid it has to be reliable (Abdolshah, 2013).

To draw conclusions based on a regression analysis of data, emphasize the importance of testing to identify any violations of the underlying assumptions in linear regression analysis. Tests of reliability, validity and regression assumptions are described in this section.

3.8.2 Test of Reliability

Reliability is a set of measurement items. A reliable instrument is expected to measure something consistently. It may not necessarily be what it is supposed to be measuring. In assessing the reliability of research instruments, internal consistency reliability is the most commonly used test and was used in this study. Reliability is an indicator of how well the different items are homogeneous and capable of independently measuring the same concept so that the respondents attach the same overall meaning to each of the items (Sekaran & Bougie, 2016). Reliability test was done to establish whether the questions measure the expected aspects regarding the variables. The higher the reliability is the better the pre-test reliability and consequently, the stability of the measure across time (Sekaran & Bougie, 2016). According to Abdolshah, (2013) the reliability of a study ensures that errors and biases are minimized. Reliability requires that the process of research as applied in the study be consistent, allowing any later study to follow the exact procedures and get the same findings.

This study used Cronbach's Alpha coefficient to measure the internal consistency reliability of the measures of the constructs. Abdolshah (2013) postulates that Cronbach's alpha coefficient is used because it is the most widely used measure of internal consistency reliability.

According to Sekaran & Bougie (2016), Cronbach's Alpha correlates each item with each other item and the total score. Items with weaker correlations or low scores are removed to leave an instrument with a high degree of homogeneity. Saunders, Lewis & Thornhill (2016) observed that reliability co-efficient findings of Cronbach's Alpha of 0.9 is excellent, 0.80 is considered good, 0.7 is acceptable, 0.6 is poor, and while 0.5 and below is unacceptable. Kothari & Garg (2014) admit that based on this an internal consistency analysis was performed for each statement corresponding to each of the identified supply chain process integration constructs. To ensure reliability, the items were based on the estimates of the variability of participants responding to the items.

The research instruments were administered to the same respondents after one month then tested for reliability. The pilot test used 16% (5) questionnaires and the results of reliability test co-efficient on Cronbach's alpha were as follows; Supply chain process integration 0.859, Information technology infrastructure 0.929, Government policy 0.694 and supply chain performance 0.909. This showed a strong internal consistency among measures of variable items because all variables had 0.7 and above (Saunders, Lewis & Thornhill, 2016). Gujarati, Porter & Gunasekar (2013) posits that internal consistency of a set of measurement items refer to the degree to which the items are homogeneous and can be estimated using a reliability coefficient such as Cronbach's Alpha. Cronbach's Alpha correlates each item with each other and the total score. Items with weaker correlations or low scores can be removed to leave an instrument with a high degree of homogeneity.

3.8.3 Test of Validity

According to Cooper & Schindler (2014), validity is the degree to which a research instrument serves the purpose for which it was constructed. It is the degree to which results obtained from the analysis of the data represents the phenomena under study. To assess the validity of the study instruments this study examined two commonly used forms of validity tests: Face or content validity and construct validity. Face validity is a measurement of validity that depends on the judgment of others (the scientific community) that the measure is measuring the construct (Abdolshah, 2013). While criterion validity is a measurement of validity that relies on external sources and concurrent validity relies on pre-existing verification of a construct or predictive validity which relies on agreement with future behavior (Noor, 2014). Construct validity has two types: convergent validity, which compares the concept, developed using other methods, and discriminant validity, which states that different constructs are different for instance A and B are not associated (Abdolshah, 2013).

Construct validity is a combination of convergent and discriminant validity (Sekaran & Bougie, 2016). To establish the face validity of the research instrument, this study used existing scales that have already been validated by other researchers. Further, the research instrument was subjected to critique by experts in procurement and supply chain management in the School of Business of the the Technical University of Kenya and Jomo Kenyatta University of Agriculture and Technology, Nairobi, who assessed the instrument items and terminology to ensure it was clear and logical. The comments of the critique were used to revise the instrument to enhance face validity.

Further, wording and format modifications were made to improve the clarity of the questions and the general appearance of the questionnaire.

3.8.4 Construct Validation: Factor Analysis

The most widely used forms of factor analysis are Principal Component Analysis (PCA) and principal-axis factoring (factor analysis). Though there are other methods, such as alpha, image, and maximum likelihood factoring, these methods are used less frequently. Factor analysis is a statistical method that is primarily concerned with describing the variation of variance that is shared by the scores of people on three or more variables. This variance is referred to as a common variance. Specific variance describes the variation that is specific to a variable and that is not shared with any other variable. Error variance is the variation due to the fluctuations that inevitably result from measuring something. Since factor analysis cannot distinguish between specific and error variance, they are combined to form unique variance. The difference between PCA and factor analysis lies in how they handle unique variance such as specific and error variance.

In PCA, it is assumed that the variable is perfectly reliable and without error, therefore, PCA uses all variances in its analysis. In factor analysis, the common variance is the only variance used. Since PCA examines the total variance of a test, the variance is set at one, while for principal-axis factoring it varies between zero and one. The variance of a test to be explained is known as its commonality. The relationship between each item or test and a factor is explained as a correlation or loading (Chen, Haga & Fong, 2016).

Confirmatory Factor Analysis (CFA) using Principal Component Analysis and Varimax Rotation procedures was performed to verify the actual structure of the data, which reflected the expected structure from the previous validity studies. The CFA specifies different factor solutions for each variable.

To determine which factors to retain in a stable instrument, the criteria used are based on the Eigenvalues. The Eigenvalues indicate how much variation each factor or component can explain. These criteria include the scree plot, Kaiser Criterion (K1) and the variance explained. The scree plot graphically represents the eigenvalues in descending order and connects with a line. It is recommended to examine the line where it levels off. The Kaiser Criterion suggest only including factors where eigenvalues are greater than one. The initial eigenvalues displayed in the tables indicate which factors that have an eigenvalue greater than one that was retained for each variable. Therefore, the analysis of the data set suggests that for different variables, they should have a different number of construct structures that provide stable and generalized measures for the variables as well as is consistent with the theoretical frameworks supporting this work.

3.8.5 Check for Multicollinearity

Regression analysis was used as the main analysis technique to test the research hypotheses. Hence it was imperative to ensure that the assumptions of regression analysis were fulfilled. The assumptions of linearity and homoscedasticity, normality and multicollinearity were tested when conducting regression analysis. To test for linearity and homoscedasticity, a scatterplot of standardized residuals (ZRESID) against standardized predicted (ZPRED) values was used. The graph of ZRESID and ZPRED should look like a random array of dots evenly dispersed around zero. If there is any sort

of curve in this graph then the chances are that the data have been the assumption of linearity (Abdolshah, 2013). If the graph funnels out, then chances are that there is heteroscedasticity, unequal variances in the data, one of the most common violations of homoscedasticity assumption.

To assess normality, the normal probability plot, which compares the cumulative distribution of actual data values with the cumulative distribution of a normal distribution (Abdolshah, 2013) was used. The normal distribution forms a straight diagonal line, and the plotted data values are compared with the diagonal. If a distribution is normal, the line representing the actual data distribution closely follows the diagonal (Abdolshah, 2013). The assumption multicollinearity of the predictor variables was tested using the diagnostics of tolerance and variance inflation factor (VIF). A tolerance of below 0.1 or a VIF of greater than 10 is considered to indicate a serious problem of multicollinearity (Abdolshah, 2013). Further to the reliability tests, a multicollinearity test was done at the pilot stage to ensure that the accepted independent variables do not exhibit collinearity amongst themselves. A situation in which there is a high degree of association between independent variables is said to be a problem of multicollinearity which results in large standard errors of the coefficients associated with the affected variables. According to Saunders, Lewis & Thornhill, (2016), multicollinearity can occur in multiple regression models in which some of the independent variables are significantly correlated among themselves.

Multicollinearity or linear inter-correlation among variables means that there is a correlation among the independent variables, which leads to testing the same thing. In a regression model that best fits the data, independent variables correlate highly with

dependent variables but correlate, at most, minimally with each other. This problem was solved by ensuring that there is a large enough sample as multicollinearity is not known to exist in large samples.

The variables were tested by dropping one variable at a time and observing the value of the adjusted R2, the variables that give the highest adjusted R2 value are the ones that determine the supply chain performance in public universities. If a variable has collinearity tolerance below 0.2, it implies that 80% of its variance is shared with some other independent variables. The Variance Inflation Factor (VIF) should also be below 5. The VIF is generally the inverse of the tolerance and multicollinearity is associated with VIF and tolerance values above 5 and below 0.2 respectively. As depicted in Table 4.4 the results indicated tolerance range from 0.486 to 0.673 and therefore it's reciprocal, the VIF was between one and two, which is below the maximum threshold value. This indicated that the data set displayed no multicollinearity.

3.9 Data Analysis and Presentation

Data preparation began with instrument checking, which involved eliminating unacceptable questionnaires. These included incomplete, little variance, missing pages or respondent not qualified. This was then followed by data editing which sought to correct illegible, incomplete, inconsistent and ambiguous answers (Saunders, Lewis & Thornhill 2016). The next step in data preparation was data coding. A codebook for the different variables was prepared based on the numbering structure of the questionnaires. The study used the Statistical Package for Social Sciences (SPSS) as a tool for all quantitative data analysis. SPSS was considered appropriate since it allows the researcher to follow a clear set of quantitative data analysis procedures that leads to increased data validity and

reliability and demonstrates the relationship between the research variables. SPSS also assists in producing frequency tables for descriptive analysis. Data entry was the next step.

This is the act of transcribing data often, into a computer program followed by data cleaning which reviewed data for consistencies. Inconsistencies may arise from faulty logic out of range or extreme values. The next step involved carrying out diagnostic tests (Gujarati, Porter & Gunasekar 2013). The study used the Shapiro-Wilk test to determine whether the data were normally distributed. A normality test is an assessment of the normality of data and also a prerequisite for many statistical tests as normal data is an underlying assumption in parametric testing. There are two main methods of assessing normality - graphically and numerically. The results inform the researcher if the significance value of the Shapiro-Wilk Test is greater than 0.05 then the data is normal. If it is below 0.05 then the data significantly deviate from a normal distribution and Durbin Watson method to test autocorrelation of the variables.

According to Wan, Wang, Liu & Tong, (2014), data analysis involves a reduction of accumulated data to a manageable size, developing summaries, looking for patterns and applying statistical techniques. Concerning quantitative data, nominal data from the socio-demographic information section was analyzed by the use of percentages and frequencies. This included the level of education, years of service and respondent departments. Besides, non-parametric data were analyzed descriptively by the use of measures of central tendency and measures of dispersion as the tools of data analysis. The arithmetic mean was as a measure of central tendency while the standard deviation was used as a measure of dispersion.

3.9.1 Correlation Analysis

For the parametric data, Pearson's product-moment correlation analysis(r) and multivariate regression analysis were used to test the relationship between variables. The Pearson product-moment correlation coefficient (or Pearson correlation coefficient, for short) is a measure of the strength of a linear association between two variables and is denoted by r. A Pearson product-moment correlation attempts to draw a line of best fit through the data of two variables, and the Pearson correlation coefficient, r, indicates how far away all these data points are to this line of best fit.

The Pearson correlation coefficient, r, can take a range of values from +1 to -1. A value of 0 indicates that there is no association between the two variables (Gujarati, Porter & Gunasekar 2013). A value greater than 0 indicates a positive association; that is, as the value of one variable increases, so does the value of the other variable. A value less than 0 indicates a negative association; that is, as the value of one variable increases, the value of the other variable decreases.

3.9.2 Regression Models

The study also used univariate and multivariate regression models to test the relationships between variables. A simple linear regression model (univariate model) has one outcome and one predictor, whereas a multivariate linear regression model has one outcome and

multiple predictors. The regression analysis also provided other test statistics like t-Tests, adjusted R2 and F-test. The study applied a 95% confidence interval. A 95% confidence interval indicates a significance level of 0.05. This implies that for an independent variable to have a significant influence on the dependent variable, the p-value ought to be below the significance level (0.05).

Farouk (2015) in his study on the impact of supply chain logistics performance index on the control of neglected tropical diseases in low and middle-income countries, used the regression model, and the residual scatter plot which predicted that the two variables are linearly related, such that variations in logistics services correlate with MDA coverage. However, the relationship between the two was statically insignificant (p = 0.078) at a 95% confidence interval (-1.26 to 23.44).

The following multiple regression model was used:

Multiple Regression Analysis

$Y= \alpha +\beta_1 X_1 +\beta_2 X_2+\beta_3 X_3+ \acute{\varepsilon}$

Y= Supply Chain Performance of Public Universities

α= constant (intercept)

$\beta_1\ \beta_2\ \beta_3$ - Beta Coefficient parameters to be determined

X_1= Information flow integration

X_2= Physical flow integration

X_3= Financial flow integration

$\acute{\varepsilon}$ = Error term

To test for hypothesis two which stated that supply chain process integration capabilities have no significant influence on information technology infrastructure in public universities, the composite index for both the dimensions measuring the constructs under

supply chain process integration capabilities and information technology infrastructure were computed and a multiple regression analysis applied. The following multiple regression model was used:

Multiple Regression Analysis

$$\mathbf{Y= \alpha +\beta_1 X_1 +\beta_2 X_2+\beta_3 X_3+ \acute{\varepsilon}}$$

Y= Information technology infrastructure

α= constant (intercept)

$\beta_1\ \beta_2\ \beta_3$ - Beta Coefficient parameters to be determined

X_1= Information flow integration

X_2= Physical flow integration

X_3= Financial flow integration

$\acute{\varepsilon}$ = Error term

The third hypothesis was that Information technology infrastructure has no significant influence on supply chain performance of public universities. This was tested using multiple regression analysis, first the composite indexes were computed for both variables then an average index was used to run a regression analysis. The regression model was as indicated

Multiple Regression Analysis

$$\mathbf{Y= \alpha +\beta_1 X_1 +\beta_2 X_2 + \acute{\varepsilon}}$$

Y= Supply chain performance of public universities

α= constant (intercept)

$\beta_1\ \beta_2\ \beta_3$ - Beta Coefficient parameters to be determined

X_1= Internal infrastructure

X_2= External infrastructure

ε = Error term

The commonly used Baron and Kenny's (1986) approach was used. The mediating effect was examined through a four-step process as shown in Figure 3.1. The hypothesis was that information technology infrastructure has no significant mediating effect on the relationship between supply chain process integration capabilities and SC performance of public universities.

Step one entailed the dependent variable Y being regressed on the independent variable X to determine the standardized regression coefficient (beta for path c) in order to confirm if X is a significant predictor of Y. After beta for path c was found to be significantly different from zero the test progressed to step two where the mediator was regressed on the independent variable to estimate the standardized beta regression coefficient for path a in order to establish the extent and direction of the relationship. Subsequent to the beta for path a being found significantly greater than zero the test progressed to step three to regress Y on M in order to ascertain the beta coefficient for path b. After beta path b was found to be significant the dependent variable Y was regressed on X while controlling the effect of M on Y through a hierarchical regression analysis that treated M and X as successive independent variables. Upon confirming both coefficients for paths a and b to be significant, then M was established as mediating the relationship between X and Y and c^1 was assessed to determine the link strength according to the test procedure (Memon,

Cheah, Ramayah, Ting, & Chuah, 2018). The testing steps along a path diagram are illustrated in Figure 3.1.

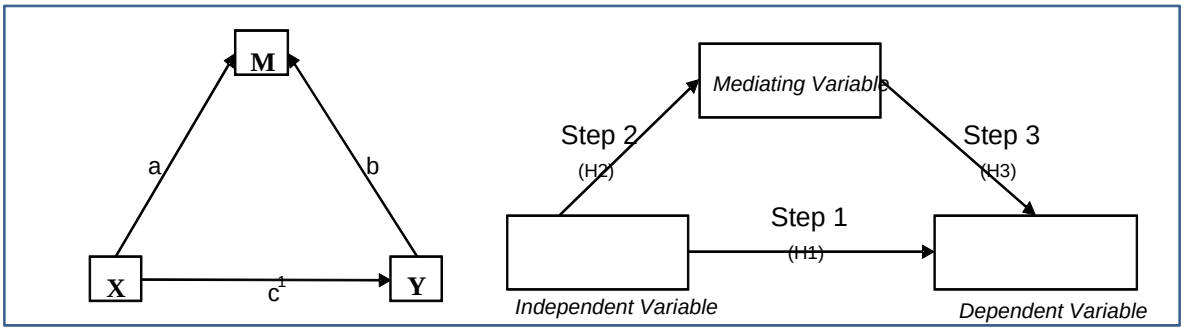


Figure 3.1: Mediation testing steps. (Memon, Cheah, Ramayah, Ting & Chuah, 2018)

The stepwise regression models were:

$Y= \alpha+ \beta_1X_1+ \acute{\varepsilon}$

$W= \alpha+ \beta_1X_1+\acute{\varepsilon}$

$Y= \alpha+ \beta_1W+ \acute{\varepsilon}$

$Y= \alpha+ \beta 1\ X_1+ \beta_2W+\acute{\varepsilon}$

α =constant (intercept)

$\beta_1\ \beta_2$ = Coefficients.

X_1= supply chain process integration capabilities.

Y = supply chain performance.

W = Information technology infrastructure.

$\acute{\varepsilon}$= Error term.

Model 1 = Step one involved regressing supply chain process integration capabilities with supply chain performance.

Model 2 = in step 2 supply chain process integration capabilities was regressed against information technology infrastructure.

Model 3 = step three the influence of information technology infrastructure on supply chain performance is tested using a simple linear regression model.

Model 4 = Step four tested the influence of supply chain process integration capabilities on supply chain performance while controlling for the effect of information technology infrastructure. These tests were done using simple linear regression analysis.

A moderator is a variable that affects the direction and the strength of the relationship between an independent or predictor variable and a dependent criterion variable. This variable may reduce or enhance the direction of the relationship between a predictor variable and a dependent variable, or it may change the direction of the relationship between the two variables from positive to negative. A moderator is supported if the interaction of predictor and moderator on the outcome of the dependent variable is significant. The Moderation tests involved testing for an interaction term using hierarchical multiple regression analysis for the hypothesis that government policy has no significant moderating influence on the relationship between supply chain process integration, information technology infrastructure and supply chain performance of public universities where in the first step the independent variable and moderating variable were analyzed. The interaction term (derived from the standardized independent and moderator variables) was factored in the second step. Moderation was established after the additional variance beyond that explained by the predictor and moderator variable were found significant.

As illustrated in Figure 3.1, β_1 is the regression coefficient relating the independent variable X to Y when Z=0; β_2 is the coefficient relating the moderator variable Z to Y when X=0; and β_3 is the coefficient for the interaction term which when statistically different from zero then it is determined that Z moderates the relationship between X and Y.

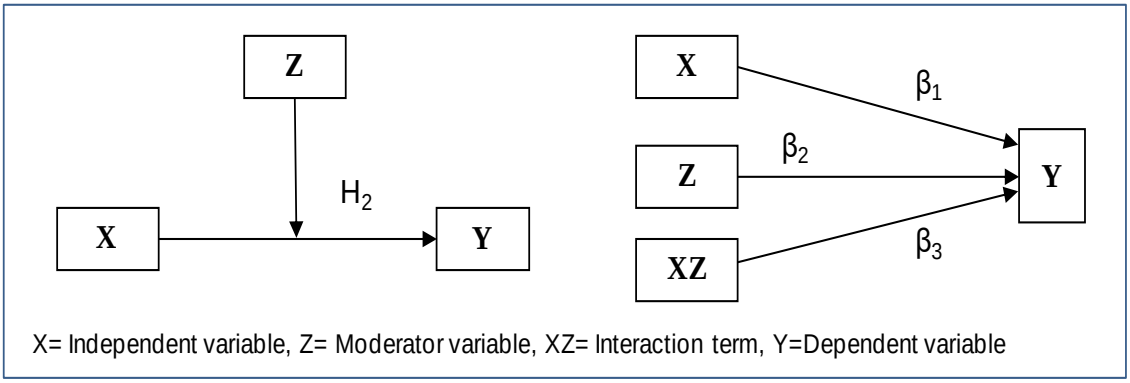


Figure 3.2: Moderation Path Diagram adopted from Memon, Cheah, Ramayah,Ting & Chuah (2018)

The expression of the moderation models are derived by use of Hierarchical Régression analyses as shown below:

$Y = \alpha + \beta_1 X_1 + \acute{\varepsilon}$

$Y = \alpha + \beta_1 X_1 + \beta_2 Z + \acute{\varepsilon}$

$Y = \alpha + \beta_1 X + \beta_2 Z + \beta_3 X.Z + \acute{\varepsilon}$

α = constant (intercept),

$\beta_1\ \beta_2\ \beta_3$ = Coefficients

Y = supply chain performance of public universités

X = supply chain process integration capabilities

Z = Government policy

$\acute{\varepsilon}$ = Error term

X.Z = Supply chain process integration capabilities and government policy interaction

The composite index was computed for both supply chain process integration capabilities, government policy and performance and the hypothesis tested through Hierarchical regression analysis. In step one, supply chain process integration capabilities was regressed on supply chain performance.

In step two, supply chain process integration capabilities were regressed on government policy. In step three the interaction term between supply chain process integration capabilities and government policy was introduced. The moderation effect is confirmed when the effect of interaction term is statistically significant. The last objective was to determine the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on performance of public universities in Kenya through the hypothesis that was stated that the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on performance of public universities in Kenya is different from their individual effects was tested through multiple regression analysis through the following regression analysis. In the first regression, supply chain performance was regressed on supply chain process integration capabilities.

The following simple regression model was used:

$$\mathbf{Y= \alpha+\beta_1 X_1+\acute{\varepsilon}}$$

Y= Supply chain performance of public universities

α= constant (intercept)

β1= Coefficient parameters to be determined

X= supply chain process integration capabilities ε = Error term

In the second regression all the variables; supply chain process integration capabilities, information technology infrastructure and government policy were regressed on supply chain performance. The multiple regression model was as indicated

$$\mathbf{Y= \alpha+ \beta_1X_1+\beta_2X_2+\beta_3X_3+\acute{\varepsilon}}$$

Y= Supply chain performance of public universities

α= constant (intercept)

X_1 = supply chain process integration capabilities

$X_{2-=}$ information technology infrastructure

$X_{3=}$ government policy

$\beta_1, \beta_2, \beta_3$ are the coefficients

έ - is the error term

The two model results were compared using coefficient of determination (R^2). If R^2 for joint effect model is greater than R^2 for individual effect model, then the joint effect is greater than the individual effect on supply chain performance.

Table 3.4 shows the analytical models used to test the hypotheses. All the statistical tests were conducted at 95 percent confidence level.

Table 3.3: Summary of Objectives and Statistical Tests of Hypotheses

Objectives	Hypotheses	Statistical Tests	Interpretation
Determine the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya.	**H_{01}** Supply chain process integration capabilities have no significant influence on supply chain performance of public universities in Kenya	**Linear Regression analysis** $Y= \alpha +\beta_1 X_1 +\beta_2 X_2+\beta_3X_3+ \acute{\varepsilon}$ Y= Supply chain Performance α= constant (intercept) β_1- β_3= Coefficient parameters to be determined X_1= Information flow integration X_2= Physical flow integration X_3= Financial flow integration $\acute{\varepsilon}$ = Error term	R^2 depicts model fitness and also explains the changes in dependent variable. β_1, β_2 and β_3 are coefficient explaining the influence of a unit change in Supply chain process integration capabilities on supply chain performance. P-value, F-ratio and t-statistic explains the significance of the model constructs.
Establish the influence of supply chain process integration capabilities on information technology infrastructure in public universities in Kenya.	**H_{02}** Supply chain process integration capabilities have no significant influence on information technology infrastructure in public universities in Kenya	**Linear Regression analysis** $Y= \alpha +\beta_1 X_1 +\beta_2 X_2+\beta_3X_3+ \acute{\varepsilon}$ Y= Information technology α= constant (intercept) β_1- β_3= Coefficient parameters to be determined X_1= Information flow integration X_2= Physical flow integration X_3= Financial flow integration $\acute{\varepsilon}$ = Error term	R^2 depicts model fitness and also explains the changes in dependent variable. β_1, β_2 and β_3 are coefficient explaining the influence of a unit change in Supply chain process integration capabilities on information technology infrastructure. P-value, F-ratio and t-statistic explains the significance of the model constructs.
Assess the influence of information technology infrastructure on supply chain performance of public universities in Kenya.	**H_{03}** Information technology infrastructure has no significant influence on supply chain performance of public universities in Kenya.	**Linear Regression analysis** $Y= \alpha +\beta_1 X_1 +\beta_2 X_2 + \acute{\varepsilon}$ Y= Supply chain performance α= constant (intercept) β_1- β_3= Coefficient parameters to be determined X_1=Internal infrastructure X_2=External infrastructure $\acute{\varepsilon}$ = Error term	R^2 depicts model fitness and also explains the changes in dependent variable. β_1, β_2 and β_3 are coefficient explaining the influence of a unit change in Information technology infrastructure on supply chain performance. P-value, F-ratio and t-statistic explains the significance of the model constructs.
Establish the mediating effect of information technology infrastructure on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.	**H_{04}** Information technology infrastructure has no significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.	Step-wise Regression analysis $Y= \alpha+ \beta_1X_1+ \acute{\varepsilon}$ $W= \alpha+ \beta_1X_1+\acute{\varepsilon}$ $Y= \alpha+ \beta_1W+ \acute{\varepsilon}$ $Y= \alpha+ \beta1\ X_1+ \beta_2W+\acute{\varepsilon}$ α =constant (intercept) β_1, β_2 = coefficients X_1= supply chain process integration capabilities $Y_=$ supply chain Performance W = Information technology infrastructure $\acute{\varepsilon}$= Error term	R^2 depicts model fitness and also explains the changes in dependent variable. β_1, β_2 and β_3 are coefficient explaining the influence of a unit change in each of supply chain process integration capabilities and Information technology infrastructure on supply chain performance. P-value, F-ratio and t-statistic explains the significance of the model constructs.

Determine the moderating effect of government policy in the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.	**H_{05}** Government policy has no significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.	**Hierarchical Regression analysis** $Y= \alpha+ \beta_1X + \acute{\epsilon}$ $Y= \alpha+ \beta_1X+ \beta_2Z+\acute{\epsilon}$ $Y= \alpha+ \beta_1X+ \beta_2Z+\beta_3 X.Z + \acute{\epsilon}$ α =constant (intercept), $\beta_1, \beta_2, \beta_3$= coefficients $Y_=$ supply chain performance ; X= supply chain process integration capabilities, Z= Government policy $\acute{\epsilon}$= Error term; X. Z= supply chain process integration capabilities and Government policy interaction	R^2 depicts model fitness and also explains the changes in dependent variable. β_1,β_2 and β_3 are coefficient explaining the influence of a unit change in each of supply chain process integration capabilities and government policy on supply chain performance. P-value, F-ratio and t-statistic explains the significance of the model constructs.
Establish the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya.	**H_{06}** The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is different from their individual effects.	**Multiple Regression analysis** $Y= \alpha+ \beta_1X_1+\beta_2X_2+ \beta_3X_3+ \acute{\epsilon}_5$ Y= Supply chain performance α= constant (intercept) X_1 = supply chain process integration capabilities $X_{2-=}$ information technology infrastructure $X_{3=}$ government policy $\beta_1, \beta_2, \beta_3$ are the coefficients ϵ-is the error term	R^2 depicts model fitness and also explains the changes in dependent variable. β_1, β_2 and β_3 are coefficient explaining the influence of a unit change in each of the supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance. P-value, F-ratio and t-statistic explains the significance of the model constructs.

3.10 Assumptions of the Regression Model

There are assumptions which justify the use of linear regression models for purposes of inference or prediction. The model was assumed to have; Normality in that the sample data has been drawn from a normally distributed population, Linearity of the relationship between dependent and independent variables, Multicollinearity, Homoscedasticity (constant variance) of the errors and autocorrelation, Independence of the errors that is (no serial correlation). If any of these assumptions is violated (example if there are nonlinear relationships between dependent and independent variables or the errors exhibit correlation, heteroscedasticity, or non-normality), then the forecasts, confidence intervals, and scientific insights yielded by a regression model may be (at best) inefficient or (at worst) seriously biased or misleading.

3.11 Diagnostic Tests

According to Pallant, (2013) regression diagnostic is one of a set of procedures available for regression analysis that seeks to assess the validity of a model in any of a number of different ways. This assessment may be an exploration of the model's underlying statistical assumptions, an examination of the structure of the model by considering formulations that have fewer, more or different explanatory variables, or a study of subgroups of observations, looking for those that are either poorly represented by the model (outliers) or that have a relatively large effect on the regression model's predictions. This study, therefore, evaluated these assumptions by testing for linearity, autocorrelation, multicollinearity, and heteroscedasticity.

3.11.1 Linearity

There must be a linear relationship between the outcome variable and the independent variables. Prior to performing linear regression analysis, researcher tested the data for linearity to find out whether data that was sampled from a population that relates the variables of interest was in a linear fashion.

Based on the ANOVA, value sig. deviation from linearity of p-value greater than 0.05 it can be concluded that there is a linear relationship between the dependent and in independent variables.

3.11.2 Heteroscedasticity

The crucial assumption of classical linear regression model is that the volatility that has occurred in the model should be uniform in nature (homoscedasticity).

If the assumption is not satisfied by the model, then one would have to consider the model to have been exposed to heteroscedasticity problem. Based on the Glejser’s test for

heteroscedasticity, output sig. coefficients greater than 0.05, it can be concluded that there is no heterscedasticity problem.

3.11.3 Autocorrelation

Another key assumption in regression model is that the error terms are independent of each other. This study presents a simple test to determine whether there is autocorrelation (serial correlation), i.e. where there is a (linear) correlation between the error term for one observation and the next. When auto-correlation is present, it is suspected that t values for regression parameter's estimates are unduly large making corresponding p-values unduly small. In other words, in presence of auto-correlation, regression parameter's estimates may wrongly be interpreted as significant. DurblinWatson statistic should be between 1.5 and 2.5 and if the rule is true then the data is not auto correlated.

3.11.4 Multi-collinearity

Further to the reliability tests a multi-co linearity test was done to ensure that the accepted independent variables did not exhibit collinearity amongst themselves. A situation in which there is a high degree of association between independent variables is said to be a problem of multi-co linearity which results into large standard errors of the coefficients associated with the affected variables. According to Sekaran & Bougie (2014) multi-co linearity can occur in multiple regression models in which some of the independent variables are significantly correlated among themselves. In a regression model that best fits the data, independent variables correlate highly with dependent variables but correlate, at most, minimally with each other.

Multi-co linearity is associated with VIF above 5 and tolerance below 0.2. Cohen, Cohen, West and Aiken (2013), provided that a VIF statistic above 5 is an indicator of multicollinearity and should be removed from regression models.

3.11.5 Normality

The Kolgomorov-Smirnov test is a non-parametric test that can be used to test the underlying distribution of a given random variable. This was used to test whether the dependent variable and independent variables followed a normal distribution. If the Pvalues are less than 0.05 at 95% confidence, the study will conclude that the dependent variable and independent variables follow a normal distributed and hence fitting a linear model to the data was justified.

3.12 Ethical Considerations of the Study

Social science researchers have an ethical obligation to protect the welfare of the people they study. Although survey studies tend to be relatively innocuous compared to some alternative methodologies, there are three ethical principles that all survey studies should follow. Respondents should be informed that participation is voluntary and that they may omit answers to any particular questions if they so choose, adequate measures must be taken to protect the confidentiality of respondents and any promises made to the survey respondents must be upheld (Sekaran & Bougie, 2016). Ethical research is considered as one that does not harm, gives informed consent and respects the rights of individuals being studied (Saunders, Lewis & Thornhill, 2016).

Ethical issues formed an important component throughout the study period. Key issues addressed included anonymity of the participants, the disclosure of the research objectives and non-disclosure of sensitive information about the public university, confidentiality of information, and voluntary consents of the respondents. The researcher ensured that all the data collected was treated with confidentiality. The questionnaires were delivered to the respondents in sealed envelopes, and collected within the agreed period. The data was only handled by the research assistant and the researcher. No unauthorized person had access to the data. Once the questionnaires were recorded, they were safely kept in custody of the researcher. On the other hand, individual responses were not disclosed. In the same vein, the privacy of the participant is a crucial ethical consideration. In this regard, no information about the participants was made public. The aim of the research and the use of the information collected was fully explained to the participants. The data collected was strictly used only for the purpose of this study.

3.13 Summary of the Chapter

This chapter focused on the methodology that was used to collect and analyze the data that was required to address the research objectives and hypotheses. It described the philosophical orientation, research design, study population, data collection tools and techniques, data collection procedure, operationalization of study variables, tests of reliability and validity of research instruments, and assumptions of regression analysis. Finally, descriptive techniques for summarizing research data and inferential techniques for testing hypotheses.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

This chapter presents and discusses the study findings on the basis of descriptive analysis and inferential test of the study hypotheses. Through the use of descriptive statistics of respondents as well as university profiles are summarized. The chapter provides the response rate of the respondents, research tests, premise on which further statistical operations and analyses were carried out to test the study hypotheses. The data analyzed were obtained through a structured questionnaire along various operational indicators of the study variables. For each study variable, respondents were presented with descriptive statements in a 5-point Likert type scale and were required to indicate the extent to which the statements applied in their university.

4.2 Response Rate

The unit of analysis was the university as each university has heterogeneous capabilities and performance. The study was a descriptive cross-sectional survey, a census of 31 public universities in Kenya. Questionnaires were self-administered to heads of two departments - ICT and Procurement in each university. The study targeted 62 respondents. Follow-ups were made and 55 questionnaires from 28 universities were filled and returned in a usable form for analysis and no responses were received from 3 universities. This represented a response rate of 80.65% and taking cognizance of the nature of the study, this was considered adequate for analysis (Meiklejohn, Connor & Kypri, 2012) who proposes a score of 80-98% as good response rate, whereas Sarpong et al., (2017) suggests that a response rate of 60% is representative of the population of the study.

Further scrutiny established that 5 questionnaires were poorly filled hence the effective response dropped to 50 responses. Inspection of the missing data patterns showed that the number of missing values on the study variables was small and random. Further missing patterns in the few cases did not reveal systematic values on the items of the independent variables and the dependent variable. Since the missing values were small and randomly distributed, imputation of missing values was not considered necessary and missing values were excluded pairwise in the SPSS. This option removed cases that had a missing value on the variables being correlated or regressed only.

The high response rate could be attributed to the data collection procedure where the researcher notified the potential respondents i.e. universities ICT and supply chain Departments of the intended visit and used introductory letters by the researcher (Appendix I), and from the Technical University of Kenya (Appendix IV). The researcher also obtained a research permit from the National Commission of Science, Technology and Innovation (NACOSTI) addressed to the universities explaining the purpose and nature of the study. The researcher also utilized well trained research assistants who were equipped with skills on how to build rapport with respondents. Al-Zu'bi (2016) in a study on collaboration with suppliers and lead users in new product development and open innovation: Empirical evidence from Jordanian Companies, paid visits personally to all companies in order to ensure a high participation rate in data collection. The study yielded a response rate of 52.8%.

In another related study carried out by Oliveira *et al*. (2011) on supply chain process collaboration and Internet utilization: An international perspective of business-to-business relationships in Brazil, response rate realized was 21.4%. While a study by Blome *et al.* (2014) on supply chain collaboration and sustainability: a profile deviation analysis yielded a response rate of 18.5%. Only very few studies have crossed the 50% mark, for example the study by Alrubaiee *et al*. (2012) on relationship between B2B E-Commerce benefits, E-Market-place usage and supply chain management realized a response rate of 63%. The low response rate realized by the three scholars in the above studies might be attributed to administration of data collection instruments via mail to the respondents instead of self-administration. Most people do not read their e-mails frequently while others may possibly have changed their e-mail addresses. Postal mailing has the risk of inefficiency of the service provider which may result in low response rate. However, self-administering means meeting face-to-face with target respondents, which may lead to high response rate due to respect for the effort made.

Table 4.1: Response Rate

Category	**Questionnaires Distributed**	**Questionnaires Filled and Returned**	**Percentage %**
Procurement	31	27	87.09
ICT	31	23	74.19
Total	62	50	80.65

Source: Research Data (2018)

4.3 Research Tests

The study sought to ensure that the research scales were reliable and valid, and the data met the regression assumptions. The following section discusses the results of tests of reliability, validity and assumptions of regression analysis.

4.3.1 Test for Reliability

Reliability is a measure of degree to which an instrument yields consistent results or data after repeated trials as well as under different conditions (Saunders, Lewis & Thornhill, 2016). It is important that the measurement instrument used in a survey is reliable for it to measure consistently (Cooper & Schindler, 2014). For this study, Cronbach coefficient was used to assess the internal consistency by correlating the responses to questions in the questionnaire with each other such as calculating average correlation of items.

The internal consistency Cronbach's Alpha (α), which ranges from 0 to 1 is a coefficient that reflects how well the measurement items correlate to one another, with the closer it is to 1, the higher the reliability, hence, the coefficient alpha value ranges from zero (no internal consistency) to one (complete internal consistency) were used. Reliability factors were extracted from structured questionnaires on Likert scale (rating from scale 1 to 5). Different authors recommend different cut off points for reliability, for instance Cooper & Schindler (2014) indicate that Cronbach value of 0.7 is considered reliable whereas Abdolshah (2013) suggest a range of 0.7 to 0.9 Cronbach's alpha coefficient to be good for reliability test. This study adopted a cut off Cronbach value of 0.7 which is considered a strong measure of reliability consistency as suggested by Cooper & Schindler (2014). Cronbach's Alpha co-efficient was calculated to establish internal consistency of the instruments and results of the reliability tests are summarized in Table 4.2.

Table 4.2: Summary of Cronbach's Alpha Reliability Coefficients

Variable	Components of Variables	Cronbach's Alpha	Number of items	Decision
Supply chain process integration capabilities	Information flow, Physical flow, Financial flow	.871	16	Reliable
Information technology infrastructure	Internal information technology infrastructure, External information technology infrastructure	.941	22	Reliable
Government policy	Procurement Law and procedures	.828	8	Reliable
Supply chain performance	Internal dimension, Cost leadership, Delivery reliability, Customer service dimension	.934	21	Reliable

As shown in Table 4.2 the Cronbach's Alpha coefficients for all the variables are above the 0.7 threshold. This was confirmation of reliability of the data used to draw conclusions from theoretical concepts. Cronbach's Alpha coefficient ranged from 0.871 (Supply chain process integration capabilities) to 0.941 (Information technology infrastructure) revealing a high degree of reliability of the instrument. The results indicate that all constructs had high scores of reliability coefficients. Information technology infrastructure and supply chain performance in that order had the highest reliability scores 0.941 and .934. Government policy had lowest reliability score 0.828 although it was above the 0.7 cut-off point for reliability test (Saunders, Lewis & Thornhill, 2016). Vanichchinchai (2014) used questionnaires, employed descriptive statistics that tested reliability and validity.

4.3.2 Validity Test

Validity tests were also carried out to determine the extent to which the instrument measured what it was designed to. Validity is the ability of the research instrument to measure what it is intended to measure in terms of accuracy and meaningfulness (Saunders, Lewis & Thornhill, 2016). It is a classic evaluation criterion used in science, referring to the extent to which conclusions drawn in a study provide an accurate description or explanation of what happened. There are a variety of validity tests including face to face validity, content validity, construct validity, criterion (predictive) validity and convergent validity. For this study, construct validity and face to face validity tests were adopted. These tests were adopted because they measure the extent to which the set of questions (scale items) measure the presence of the target constructs (Abdolshah, 2013).

Face to face validity was dealt with by discussing the questionnaire with experts in procurement and ICT who confirmed their understanding of what the questions sought to measure. The researcher used expert judgment from lecturers of the Technical University of Kenya, the supervisors and the researcher's cohort in the respective departments. Ambiguous, double edged and sensitive questions were cleaned, sorted and dropped. Construct validity on the other hand, was assessed using factor analysis in order to observe how well the individual measures reflected their constructs. The factors were rotated using the Varimax Rotation method while Principal Component Analysis method was employed to extract the factors. All the variables in the study were found to be un-dimensional and valid indicators of the constructs they were to measure.

4.3.3 Tests of Statistical Assumptions

Prior to performing the descriptive and inferential analyses, statistical assumptions were tested to establish if the data met the normality, linearity, independence, homogeneity and collinearity assumptions, and it was on the basis of these results, that the measures of central tendency, dispersion, tests of significance, tests of associations and prediction were performed.

4.3.4 Test of Normality

The result depicted on Table 4.3 indicates a p-value greater than 0.05 for all the variables for Kolmogorov-Smirnov and Shapiro-Wilk tests and hence the null hypothesis that the data was normally distributed was accepted. Therefore, the data on dependent variable was normal and not violating normality assumptions. A study by Farouk (2015) tested for normality using Kolmogorov-Smirnov and the statistics gave normality of scores with a non-significant result ($p > 0.05$) indicating normality (Pallant, 2013). Another study by Spulick (2015) on the effect of executive style on risk management: A healthcare supply chain context, assessed variables for normality using Kolmogorov-Smirnov and Shapiro-Wilk normality tests. The result showed that for all variables, the scores were significant (<.05), indicating an absence of normality in distribution. From Table 4.3 the Kolmogorov-Smirnov statistic was not significant ($p> 0.05$) and therefore the conclusion was that the data was normally distributed. In addition, also Shapiro walk was not significant ($p>0.05$) indicating that the distribution of the data was normal.

Table 4.3: Test of Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Variable	Statistic	df	Sig.	Statistic	df	Sig.
Supply chain process integration capabilities	.039	50	.200*	.994	50	.151
Information technology infrastructure	.026	50	.200*	.997	50	.749
Government policy/procurement procedures	.059	50	.200*	.991	50	.160
SC Performance	.054	50	.200*	.979	50	.130

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Data normality was also demonstrated by the plotted Quantile Quantile plot (QQ plot) and normal histograms. Q-Q plots are as presented in Figures 4.1(a, b), 4.2(a, b), 4.3(a, b) and 4.4(a, b).

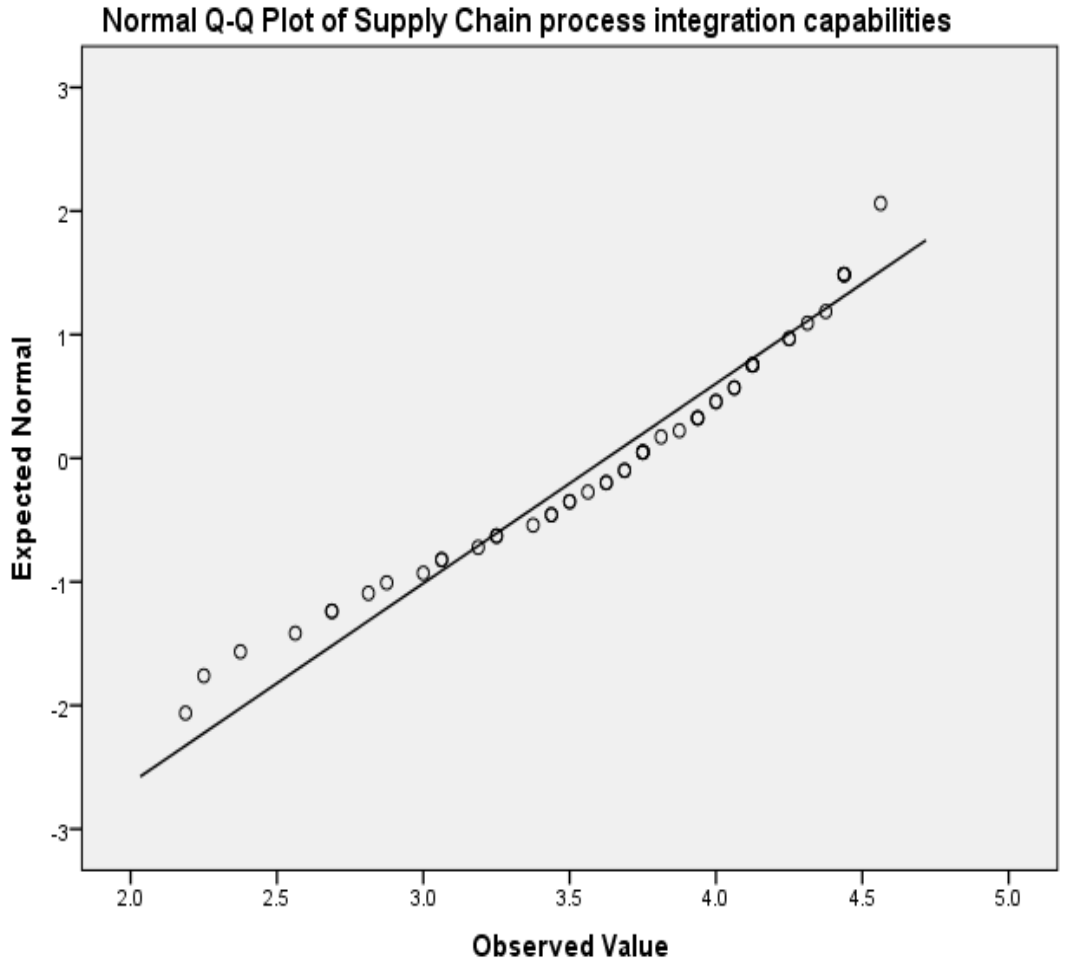


Figure 4.1 (a): Normal Q-Q Plot of Data on Supply Chain Process Integration Capabilities

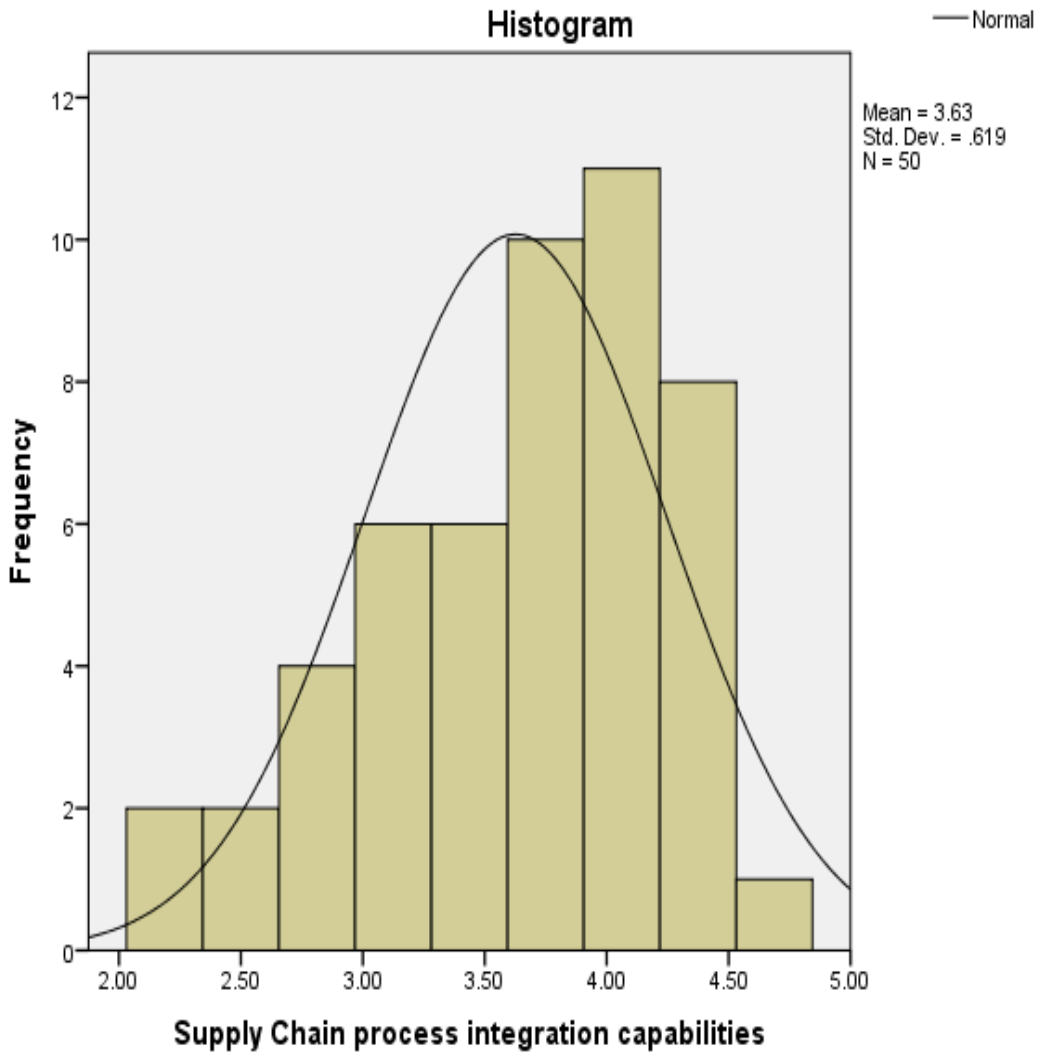


Figure 4.1 (b): Normal Histogram Plot of Data on Supply Chain Process Integration Capabilities

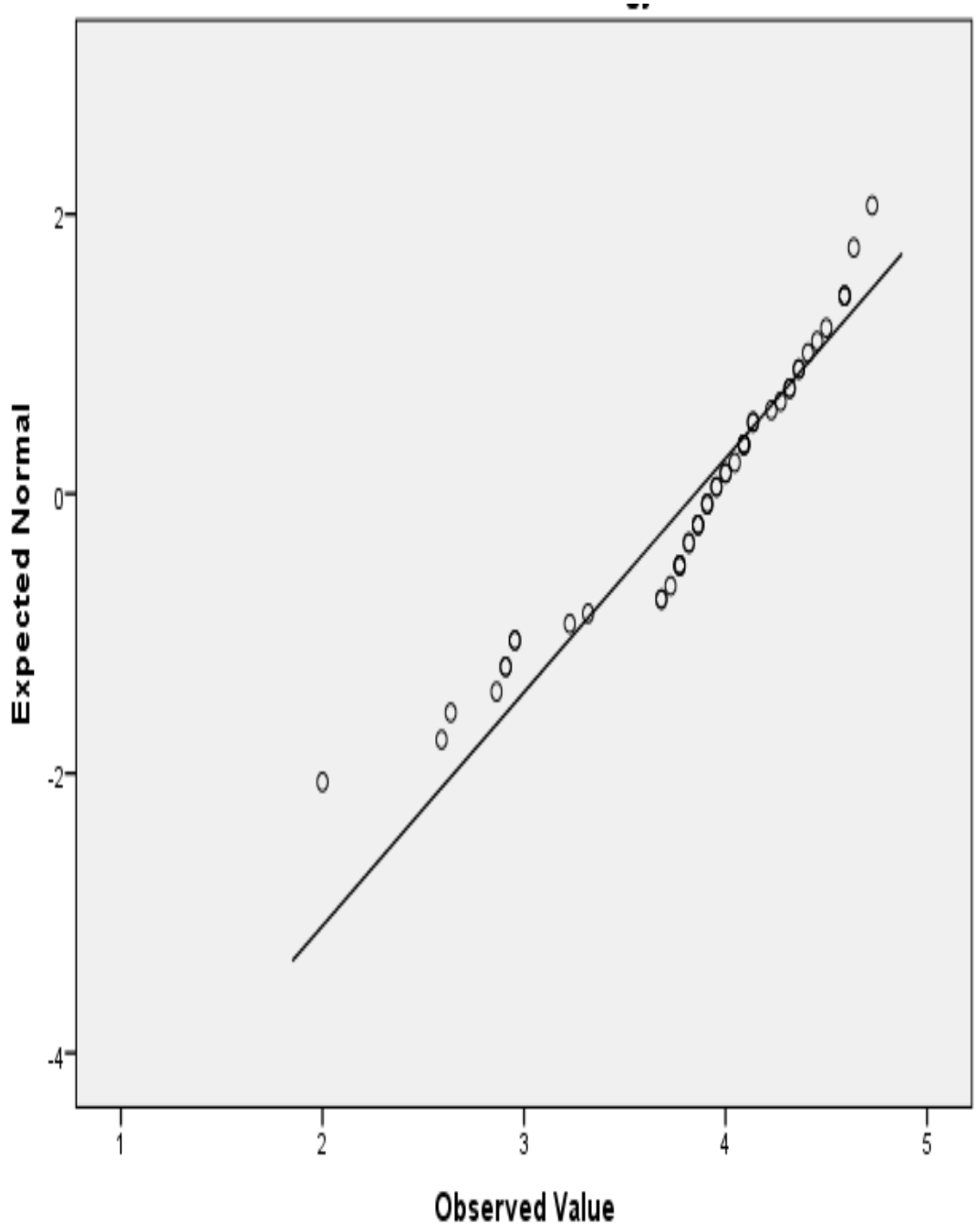


Figure 4.2 (a): Normal Q-Q Plot of Data on Information technology infrastructure

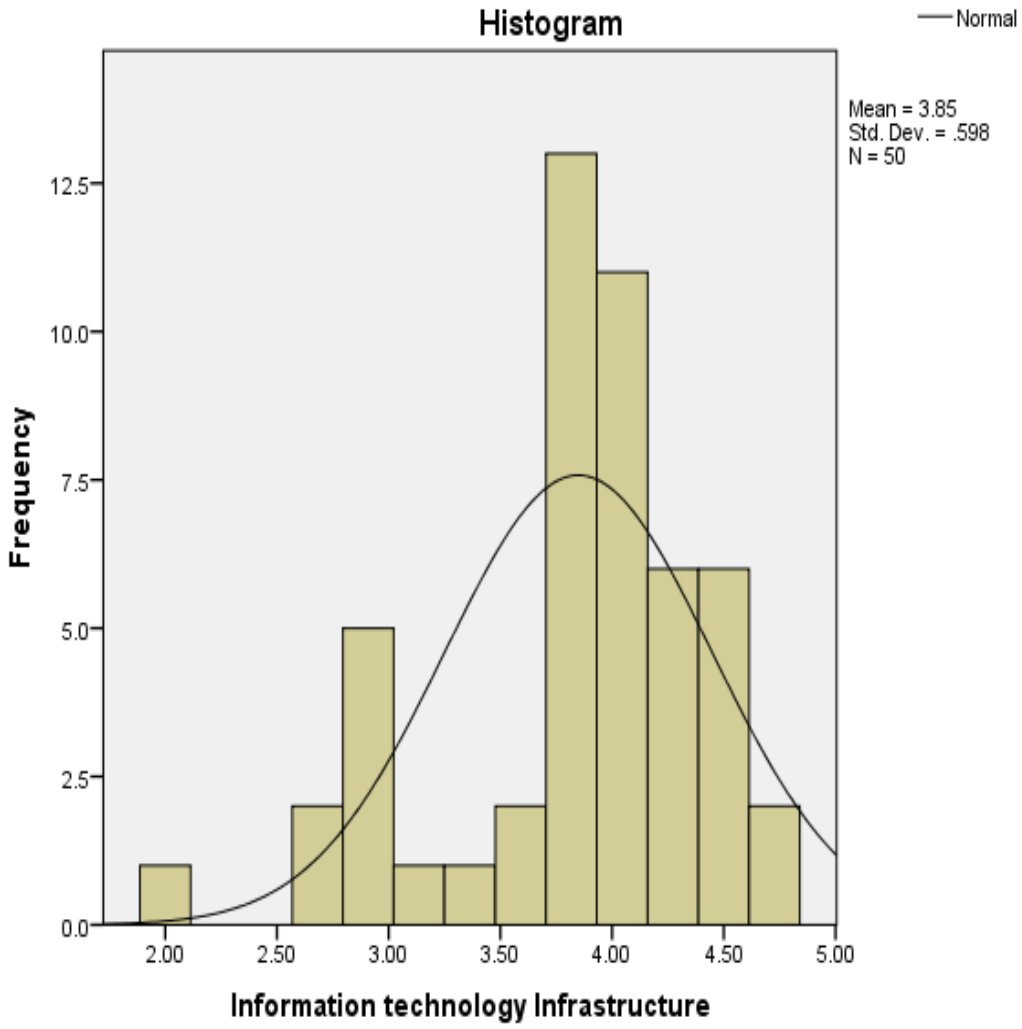


Figure 4.2 (b): Normal Histogram Plot of Data on Information Technology Infrastructure

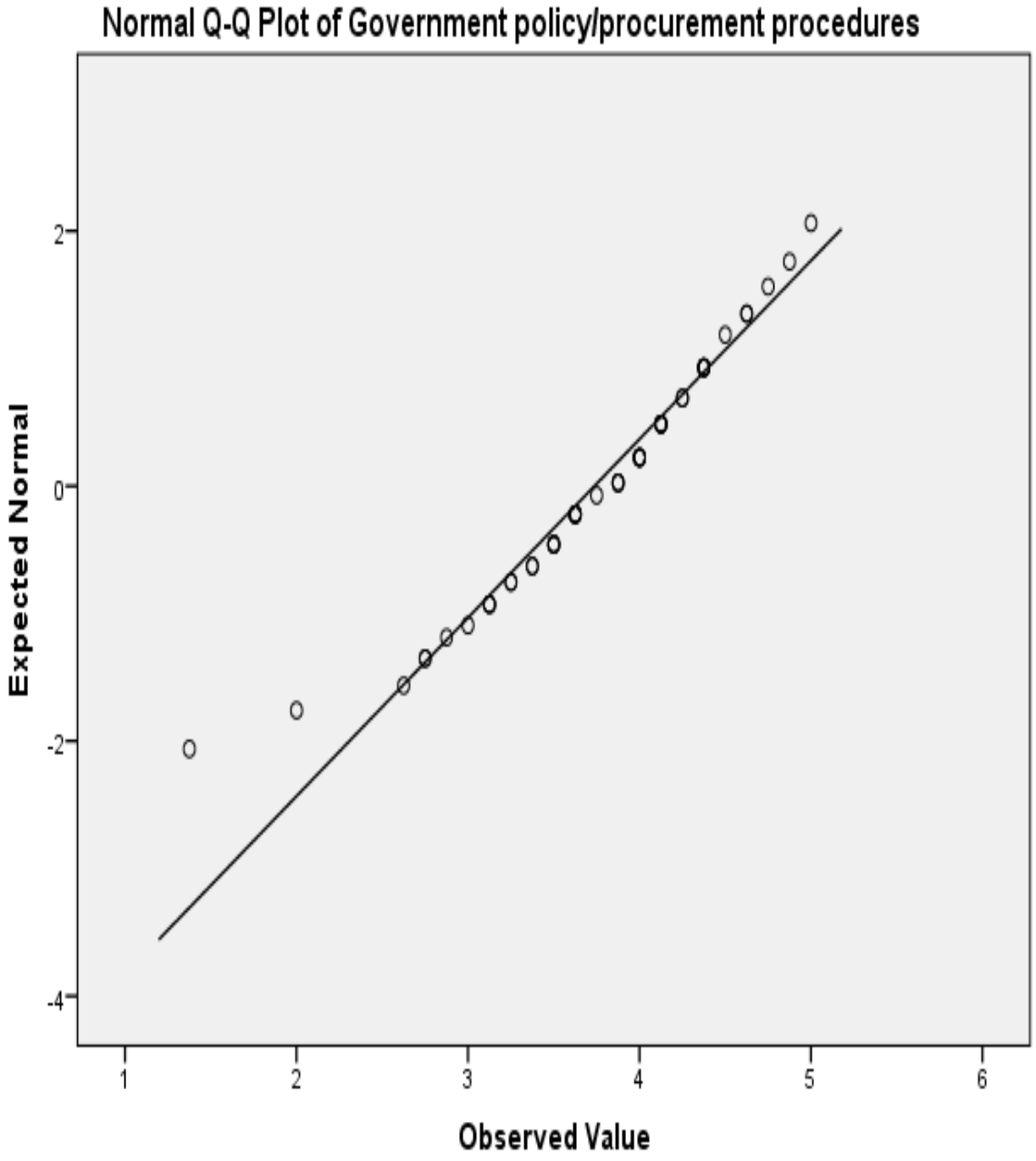


Figure 4.3 (a): Normal Q-Q Plot of Data on Government Policy/procurement |Procedures

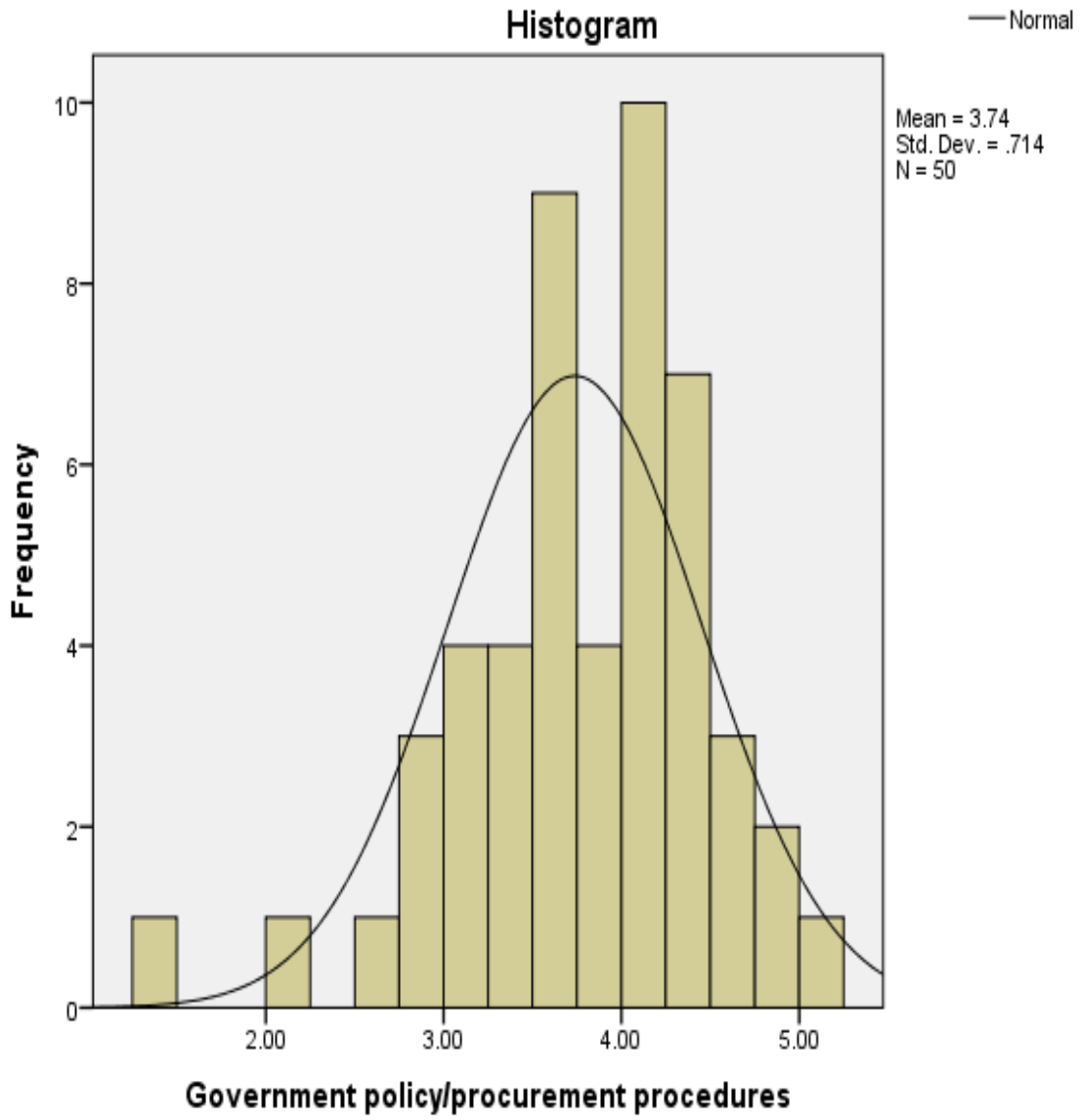


Figure 4.3 (b): Normal Histogram Plot of Data on Government Policy/procurement Procedures

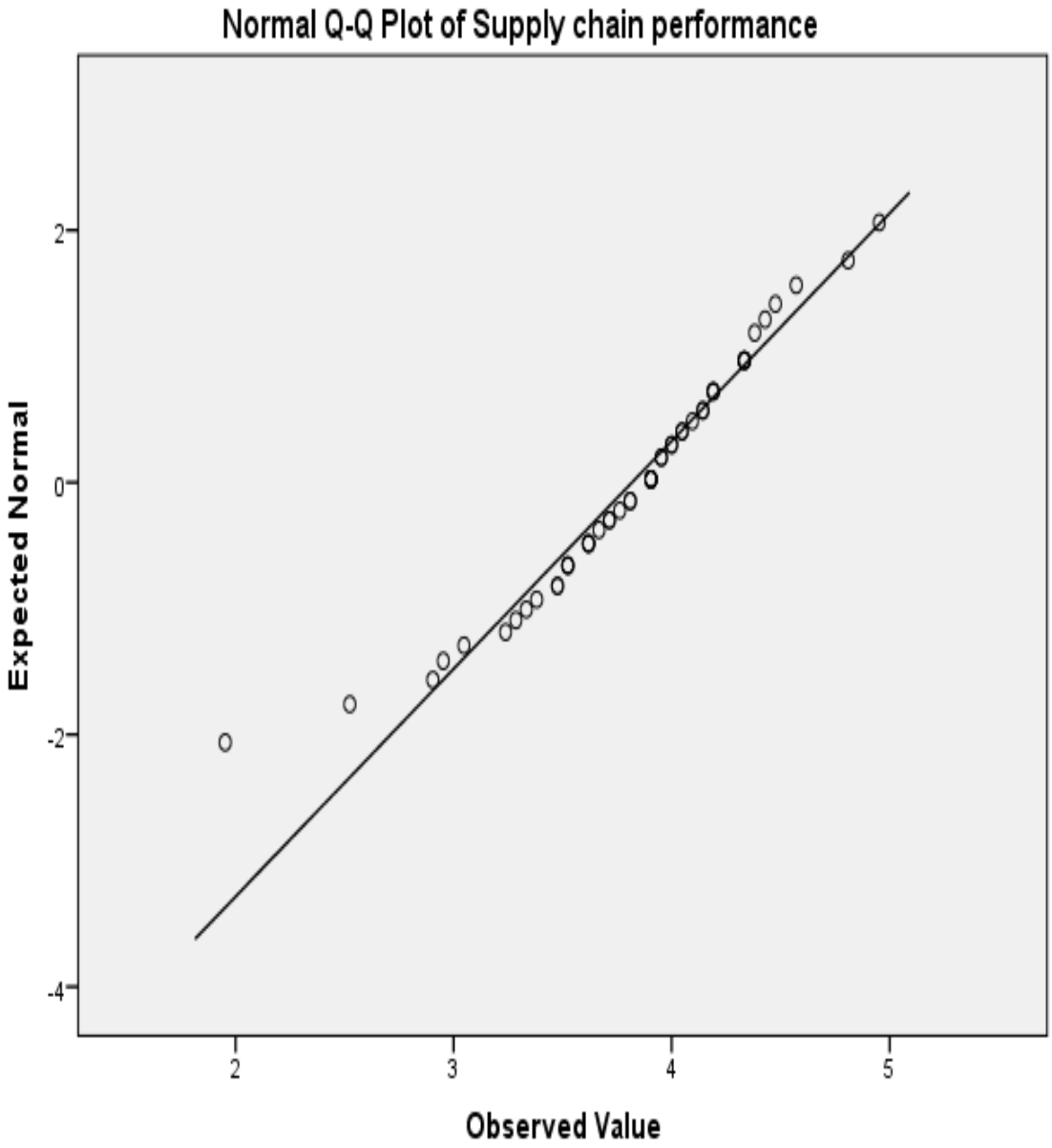


Figure 4.4 (a): Normal Q-Q Plot of Data on Supply Chain Performance

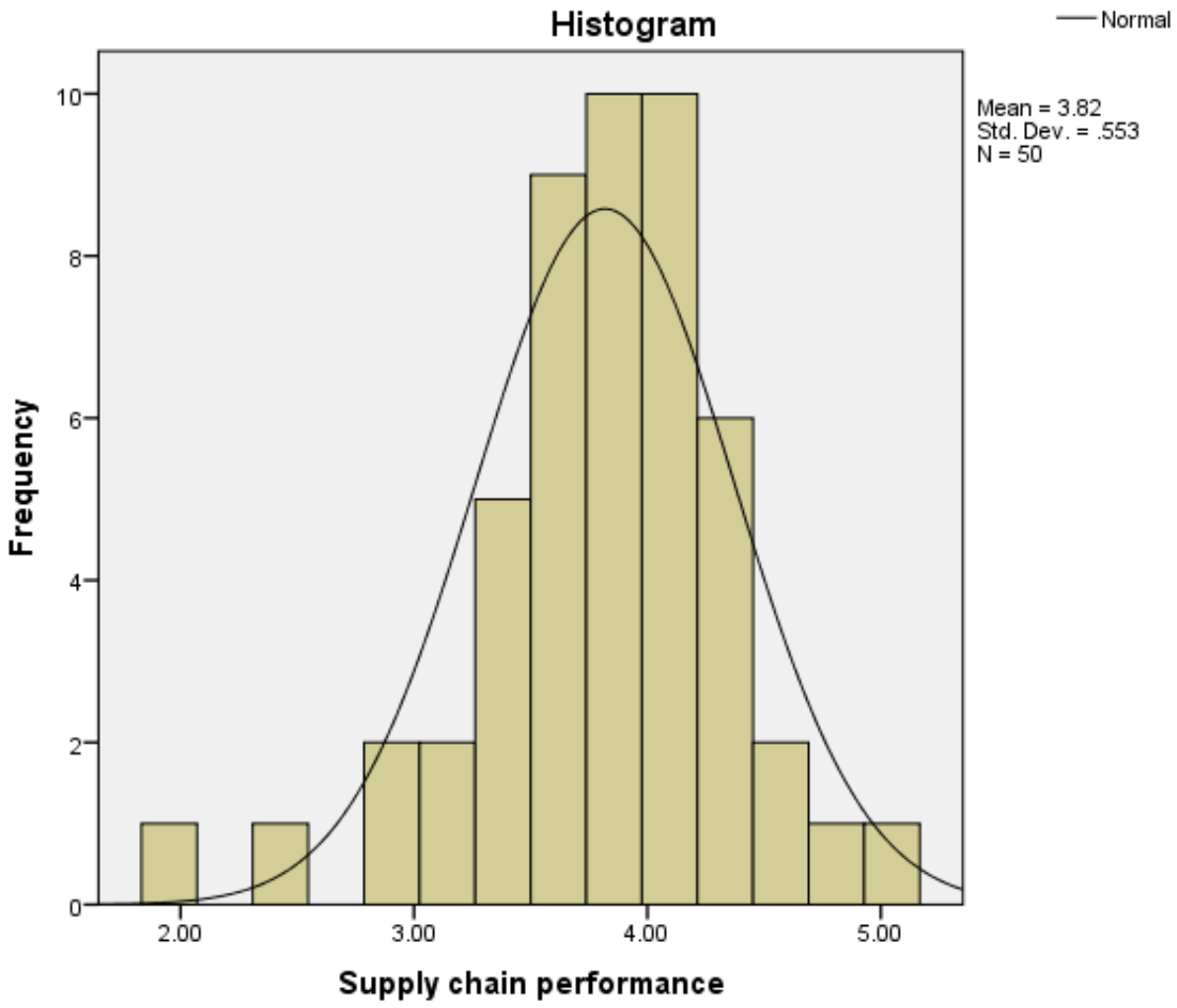


Figure 4.4 (b): Normal Histogram Plot of Data on Supply Chain Performance

The results shown above observe that the circles in the Q-Q plots and histograms show that all the observed values are normal with Q-Q plots cleaving along the line of best fit and the normal curve on histogram showing normality distribution. Therefore, all the variables had a good fit in the normal distribution.

4.3.5 Test of Multicollinearity

Multicollinearity is a statistical phenomenon in which two or more independent variables in a multiple regression model are highly correlated Kothari & Garg, (2014) meaning that one can be linearly predicted from the others with a non-trivial degree of accuracy. It is an undesirable situation where the correlations among the independent variables are strong, and this increases the standard errors of the coefficients. To help assess multicollinearity, Variance Inflation Factor (VIF) was used, which measures multicollinearity in a regression model. The general rule of thumb is that VIF exceeding 4 warrant further investigations, if there are two or more variables that will have a VIF around or greater than 5, one of these variables must be removed from the regression model (Matopoulos, Barros & Van der Vorst, 2015). The VIF values found in Table 4.4 show that, there was no multicollinearity among the independent variables, since all the values are below 5. This implies that the results of the multiple regression equation are not misleading, since the independent variables in the multiple regression equation are not highly correlated among themselves. Table 4.4 presents the results of tests for Multicollinearity.

Table 4.4: Tests for Multicollinearity

Variable		Tolerance	VIF
1	(Constant)		
	Supply Chain process integration capabilities	.673	1.486
	Information technology Infrastructure	.486	2.059
	Government policy/procurement procedures	.630	1.587

a. Predictors: (Constant), Supply Chain process integration capabilities, Information technology Infrastructure, Government policy

b. Dependent Variable: Supply Chain Performance

In this study, tolerance ranged from 0.486 to 0.673 and therefore its reciprocal, the VIF was between one and two, which is below the maximum threshold value. This indicated that the data set displayed no multicollinearity.

4.3.6 Test of Homoscedasticity

Homoscedasticity was tested to establish whether or not the variance between the dependent and independent variables is the same.

The Levene's test of homogeneity of variances was thus used and according to Shockley, (2014) the Levene statistic is significant at $\alpha = 0.05$, which implies the data lack equal variances.

Table 4.5: Test of Homogeneity of Variances

Test of Homogeneity of Variances				
Variable	Levene Statistic	df1	df2	Sig.
Supply Chain Process Integration Capabilities	1.295	10	358	.115
Information Technology Infrastructure	1.895	10	358	.107
Government Policy	2.443	10	358	.172

a. Predictors: (Constant), Supply Chain Process Integration Capabilities, Information Technology Infrastructure, Government Policy
b. Dependent Variable: Supply Chain Performance

The results in Table 4.5 indicated P-values of Levene's test of homogeneity of variances were greater than 0.05. The test therefore was not significant at $\alpha = 0.05$ confirming homogeneity.

4.3.7 Test of Linearity

To test for linearity in Table 4.6 the ANOVA test was used which computes both the linear and nonlinear components of a pair of variables.

According to Ghasemi & Zahediasl (2012) linearity is significant if the significance value for the linear component is above 0.05.

Table 4.6: Linearity (ANOVA test)

Variable	F	Sig. .
Supply Chain Process Integration Capabilities	254.469	.520[a]
Information Technology Infrastructure	.007	.27[a]
Government Policy	121.466	.26[a]

The results in Table 4.6 indicated positive significant values that were greater than 0.2. The test therefore confirmed a linear relationship.

4.3.8 Test of Independence

The Durbin-Watson test was employed for testing independence of error terms, if the statistic ranges from zero to four, it implies that the observations are independent (Roy, Raju & Mandal,2017)

Table 4.7: Independence (Durbin-Watson test)

Variable	Durbin-Watson
Supply Chain Process Integration Capabilities	2.073
Information Technology Infrastructure	1.865
Government Policy	2.072

a. Predictors: (Constant), Supply Chain Process Integration Capabilities, Information Technology Infrastructure, Government Policy
b. Dependent Variable: Supply Chain Performance

Table 4.7 the Durbin-Watson test results ranged between 1.865 and 2.073 supporting independence of error terms.

4.4 Respondents' Demographic Profiles

The study sought to establish the demographic profile of respondents and hence respondents were requested to indicate their gender, age distribution, highest level of education, designations, and number of years worked in the department. Gender diversity in an organization can influence decision making and thus organizational overall performance. The length of service that employees have in organizations is an important factor because it determines how well they can interpret the environment (Vander Weele, 2017) therefore adapt to environmental changes (Hayes, 2015) and consequently make decisions for their organizations that will eventually influence performance.

Level of formal education is critical because it reflects an individual's cognitive abilities and qualities. Years of service were also an equally important factor. Length of service could be attributed to experience and the technical nature of the management roles. They would also be in a position to utilize institutional memory on the firm's activities hence the responses would be credible. The results on the demographic profiles of respondents are presented in the Table 4.8.

Table 4.8: Respondents' Demographic Profiles

Gender	**Frequency**	**Percentage %**
Male	35	70
Female	15	30
Total	**50**	**100**
Age Distribution		
Up to 40 years	28	56
41 to 50 years	21	42
51 - 60 years	1	2
Total	**50**	**100**
Highest Education Level		
Doctorate	3	6

Master	37	74
Bachelors	10	20
Higher Diploma	0	0
Total	**50**	**100**
Designation/Title		
Senior managers	9	18
Middle level manager	41	82
Total	**50**	**100**
Years of Experience		
Up to 10 years	34	68
11-20 years	13	26
21- 30 years	3	6
Total	**50**	**100**

The study determined gender distribution in the surveyed public universities. The results in Table 4.8 show that majority of respondents sampled were male 70% with female being 30%. The one-third of female respondents could be attributed to the fact that, the new constitution has empowered women economically which evidently seen through various statutory regulations such as the gender parity rule, that is also applied in university recruitment. Gender diversity in universities could improve performance of the organizations through a number of channels and can also influence decision making in a given setup. Greater representation of women could bring in heterogeneity in values, beliefs, and attitudes, which would broaden the range of perspectives in the decision-making process and stimulate critical thinking and creativity (OECD, 2012).

Importance of gender diversity in a bid to spur innovation is critically relevant today as businesses across sectors are struggling to cope with the disruptions accompanying sweeping technological advancements. These transformations bring opportunities as well as challenges for public universities as they strive to stay competitive. Hence diversity is important especially when presented with conflicting opinions, knowledge and perspectives, since discussion and evaluation of all relevant interpretations, alternatives and consequences would be established before narrowing down to a common resolution and making the relevant task related decision. An important task of human resource management is the development and retention of an efficient workforce. Besides, the characteristics of employees may change over time and comparative advantages differ between young and older workers.

Differentiation between young and older employees, the age-specific composition of the workforce is an important question. This study sought to establish age of employees in public university in determining the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya. The results in Table 4.8 indicate that most employees were in the age bracket of 40 years and below at 56%. 42% of the employees were in age bracket 41-50 years and only 2% in the age bracket of 51-60 years. The different age groups possess different characteristics. Youngsters who are at their learning stage are more willing to learn new things and accept new ideas. Older people who have more life experiences are more mature and possess better problem-solving skills.

Sadikoglu & Olcay (2014) suggested that the older and younger employees must come together to form coherent and viable corporate culture. These values possessed by different age groups can complement each other in companies and it tends to achieve better organizational performance. Further, this is an indication that public universities had employees within the active age and they can actively embrace supply chain integration capabilities to boost performance. The youthful workforce is receptive to technological changes in the industry.

The study also sought to establish the level of education of respondents in the study. High levels of formal education are associated with a high ability to process information and to discriminate between varieties of alternatives. The results in Table 4.8 show that highest level of education among the respondents was a Master's degree at 74%. Respondents who had a Bachelor's degree as the highest levels of education were 20% and Doctorate level as highest level of education was at (6%).

The results show that according to the study, respondents were highly educated. This can be attributed to the recruitment policies of universities that require an employee to have attained minimum qualification of a degree. Secondly, universities encourage their members of staff to improve themselves by sponsoring them to go back to class. It could also be credited to the accessibility of education facilities in Kenya leading to availability of skilled workforce needed to spur supply chain management. Highly skilled employees will ensure things are done right first time, and will promote development of sustainable innovative ideas in integrative relationship, processes and products. Highly skilled employees are an asset that can guarantee the supply chain competitive advantage over competitors.

Skilled staff can instill the culture of quality management and ensure reliable capacity planning and forecasts within the supply chain. The results imply that these employees have been exposed to diverse knowledge ideas that might enhance supply chain performance in the public universities.

According to Yadav & Sharma (2015) an individual's level of formal education reflects cognitive abilities and qualities. High levels of formal education are associated with a high ability to process information and to discriminate between varieties of alternatives. The results indicate that the respondents had the ability to make informed decisions that could influence supply chain performance in the public universities. A study by King and McGrath (2002) on globalization, enterprise and knowledge, found that the education of the owner is positively related to the success of the business. Consistent with the findings of this study, majority of the respondents were well above diploma level.

The study sought to establish the designation of the respondents. Table 4.8 established that most of the employees surveyed were middle level management at 82% senior management 18%. Many employees in middle management positions could be explained by the fact that most of them were in the age bracket of less than 40 years and therefore had less working experience to warrant them senior positions in the public universities. The designation of the respondent helps in determining the ability of the respondent to provide accurate and reliable information since they have a good understanding of their supply chain partner relationships.

The respondents were asked to indicate number of years they had worked in their respective departments. The length of service in the university highlighted the level of experience.

Additionally, they would also be in a position to give institutional memory hence the responses would be credible. The results in Table 4.8 indicate that majority of the respondents had 68% up to 10 years of experience while 26% had 11-20 years' experience in the departments and only (6%) of the respondents had 21-30 years of experience. This means that majority of the respondents had relevant and adequate knowledge and institutional memory of the university. Given the number of years served by the respondents in the public universities and experience, the data collected was deemed to be reliable. Long length of service in the various departments in the public universities could be attributed to experience and the technical nature of the work. Universities are also viewed as good employers with good terms and conditions of work and this reduces exits to other sector.

4.5 University Information

The Public universities demographics considered in the study included department, number of employees in the department, years of operation as chartered university, type of technologies used for external collaboration, management systems used to manage supply chain process and categories of e-procurement process used. The Table 4.9 shows the results of the findings.

Table 4.9: Universities Demographics Profiles

Departments	**Frequency**	**Percentage (%)**
Procurement	27	54
ICT	23	46
Total	50	100
Age Distribution		
up to 29	4	8
30 – 34	12	25
35 – 39	28	56
40 – 44	3	5.5
45 and above	3	5.5
Total	**50**	**100**
Number of Employees per Department		
1-10	9	18
11-20	23	46
21-30	9	18

31-40	6	12
41-50	1	2
51-60	0	0
61-70	0	0
71-80	0	0
81-90	0	0
91-100	2	4
Total	**50**	**100**
Years of Operation as a Chartered University		
01-10	43	86
11-20	4	8
21-30	0	0
31-40	2	4
41-50	1	2
Total	**50**	**100**
Adopted Information Technology		
Sales/Demand forecast	0	0
Customer relationship management systems	20	40
Supplier relationships management systems	18	36
Vendor management inventory system	6	12
Collaborative portals	6	12
Total	**50**	**100**
Supply Chain Management Systems in the University		
Material Resource Planning	0	0
Enterprise resource planning	33	66
Decision support systems	8	16
Transport management systems	4	8
Electronic invoice and fund transfer systems	5	10
Real time and tracking systems	0	0
Total	**50**	**100**
E-Procurement Categories in the Universities		
E-MRO	0	0
E-Tendering	2	4
E-Procurement	9	18
ERP	26	52
E-Informing	7	14
E-Application/admission	6	12
E-Quotation	0	0
Total	**50**	**100**

The main objective of this study was to assess the influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. The study sought views from Procurement and ICT Department. Respondents from procurement were 54% and ICT were 46%.

The study also sought to establish the number of employees who responded as present per department. This was to establish efficiency of the departments and generally to establish workforce present for service delivery. The findings of the study indicate that majority of the departments had 11-20 employees at 46%, 21-30 employees at 18%, 1-10 employees at 18%, 31-40 employees at 12%, 91-100 employees at (4%) and lastly 41-50 employees at 2%. Number of employees per department was strictly determined by the size of the institution. Main campuses of public universities are thought to be big and therefore handle and accommodate a wide range of students and clients, therefore the various departments are expected to have more employees.

This study sought to establish the number of years of operation as chartered universities. From the findings, majority of the universities surveyed have been in operation for not more than ten years at 86%. This could be attributed to the fact that most public universities have recently received charters to become universities after being upgraded from satellite campuses and university colleges. The 8% have been in operation for 11-20 years, 4% have been in operation for 31-40 years and lastly only 2% have been operation for more than 40 years.

The study further established type of information technology adopted for external collaboration by the surveyed public universities. Respondents indicated that a customer relationship management system was the dominant type of information technology adopted in the university at 40%. Supplier relationship management systems at 36%, vendor management inventory system at 12% and collaborative portals at 12%. Customer relationship is defined as the degree to which the focal firm's relationship with customers and information about their preferences is better than its competitors.

Customer satisfaction has important implications for the economic performance of firms because it has the ability to increase customer loyalty and usage behavior and reduce customer complaints and the likelihood of customer defection (Jan, Olga & Aleksandra, 2018). The implementation of a Customer Relationship Management (CRM) approach is likely to have an effect on customer satisfaction and customer knowledge for a variety of different reasons. According to Iwano & Little (2013), CRM applications help firms customize their offerings to suit the individual customer tastes by accumulating information across customer interactions and processing this information to discover hidden patterns.

Customization of customer relationship management systems through improved technology enhances the perceived quality of products and services from a customer's viewpoint. Because perceived quality is a determinant of customer satisfaction, it follows that CRM applications indirectly affect customer satisfaction. Additionally, CRM applications also enable firms to provide timely, accurate processing of customer orders and requests and the ongoing management of customer accounts. Further supplier relationship management systems have facilitated the process of interaction and collaboration between an organization and its suppliers to ensure an effective flow of supplies (Kumar, Singh & Shankar, 2015).

The study sought to establish management systems adopted by the public universities to manage supply chain process. The results indicate majority of the public universities adopted ERP at 66%. ERP is a standard software package that provides integrated transaction processing and access to information that spans multiple organizational units and multiple businesses.

Implementation of the ERP system has a positive effect on organizational performance. The magnitude of its impact is smaller immediately after implementation, being intensified over time.

The study further sought to establish e-procurement categories present in public universities in Kenya. The dominant procedure adopted by public universities in Kenya was ERP at 52%. Other procedures established by the study were e-procurement at 18%, e-informing at 14%, and e-application/admission at (12%) and finally e-tendering at 4%. To eradicate corruption in government procurement, ICT can be used to increase public participation, reduce bureaucracy and promote efficiency and transparency (Ali & Sassi, 2017). Equally Watuleke (2017) further established that corporate procurement can be enhanced through e-procurement yielding profits, establishing good procurement controls. E-procurement also contributes to reduced lead time, procurement cost and enhanced transparency (Park, 2014).

4.6 Supply Chain Process Integration Capabilities

The study sought to describe supply chain process integration capabilities in their university. Respondents were asked to indicate the extent to which they agreed that the statements on the items of dimensions of supply chain process integration capabilities described their university. The dimensions of supply chain process integration capabilities were information flow, physical flow and financial flow. Each item had a 5-point Likert-type scale, ranging from ‘strongly disagree’ (1) to ‘strongly agree’ (5). The responses were analyzed using mean scores, standard deviations and coefficient of variation. Higher mean scores indicated strong agreement on the item and lower mean score implied strong disagreement with the statements.

4.6.1 Information Flow Integration

Information flow is essential to perform internal linkages with the different business units within the firm but also with suppliers and customers. Information sharing platform is considered as an essential component of a supply chain architecture which contributes to better collaboration and integration. An efficient and effective information sharing platform should be structured to enable the whole supply chain to share essential market and operational information, improve productivity, and reduce transaction cost and time-to-market. As a centralized information platform, partners of the supply chain will continuously update operational data required by the decision-making committee, monitor the critical situation as reflected by the updated data, and coordinate the daily operational schedule.

To establish information flow in this study and its influence on supply chain performance in public universities, respondents were asked to indicate their response on a Likert type scale of 1(strongly disagree) to 5 (strongly agree) in the last five years on statements depicting information flow. Table 4.10 gives the mean, standard of deviation and coefficient of variation, t- value and significance level on statements depicting information flow in influencing of supply chain performance of public universities in Kenya.

Table 4.10: Information Flow Integration

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
8.1	Our university shares its business units propriety information with its supply chain partners	50	3.52	.81	0.23	30.57	.00
8.2	Our university shares information with its supply chain partners in advance of changing needs	50	3.72	.73	0.20	36.06	.00
8.3	Our university and its partners exchange information that helps establishment of business planning	50	3.56	.88	0.25	28.47	.00
8.4	Information exchange between our university and its supply chain partners is timely, adequate, complete, reliable	50	3.70	.79	0.21	33.16	.00
8.5	Our supply chain partners are actively involved in standardizing Supply chain practices	50	3.66	.96	0.26	26.94	.00
	Average Mean Score	50	3.63	0.84	0.23	31.04	0

The results in Table 4.10 show varied results for the factors with mean scores ranging from 3.52 to 3.72. This indicates that information flow in the supply chain process had a great influence on supply chain performance in public universities. An average coefficient of variation of 0.23 indicates minimal variation and therefore responses on the statements depicting information flow was valid and certain to contribute towards the supply chain performance in public universities.

The statement with the highest mean was that our university shares information with its supply chain partners in advance of changing needs (Mean=3.72, SD=.73, CV=0.20). This is supported by Tolmay & Badenhorst-Weiss (2015) study findings that the provision of crucial demand and production information to the producer and the OEM is essential in decoupling of upstream and downstream synchronous sequenced deliveries between the second and first-tier supplier and the first-tier and OEM facilities. Equally these findings are consistent with prior studies by (Jiguang & Bing, 2018; Pan & Shu-ping, 2016; Hefu et al., 2016; Bhatti 2016; Bhardwajb, 2016) who established that information sharing enables partners of the supply chain to optimize their daily operations with an increased return to be shared among them thus further consolidating partnerships and moving the supply chain in a positive direction.

Other statements depicting information flow were information exchange between our university and its supply chain partners is timely, adequate, complete and reliable (Mean=3.70, SD=.79, CV=0.21), our supply chain partners are actively involved in standardizing supply chain practices (Mean=3.66, SD=.96, CV=0.26). Our university and its partners exchange information that help establishment of business planning (Mean=3.56, SD=.88, CV=0.25) and our university shares its business unit's propriety information with its supply chain partners (Mean=3.52, SD=.81416, CV=0.23).

Generally, information sharing platform codifies knowledge acquired from the collaborative governance of the supply chain, shares the knowledge in the network, and routinizes the acquired knowledge to increase the network capabilities to handle disturbances.

Further, information shared on a daily basis and related to sales, logistics activities such as delivery schedules, inventory levels and production activities such as production schedules and order status helps reducing cycle time, inventory levels and improving service levels (Kembro, Selviaridis & Naslund, 2014). Moreover, information flow improves collaboration across the supply chain and plan future logistics practices (Caridi et al., 2014) and the ability of firms to improve its long-term competitiveness. Ojo & Gbadabo (2014) in their study the assessment of non-compliance with procurement proceedings in procurement of works in Nigeria, using the mean score ranking they were able to establish areas/stage and reasons for non-compliance. The efficient flow of information within the supply chain can support generating a sustainable competitive advantage. The study reports statistically significant results for factors depicting information flow since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance.

Additionally, these mentioned factors had t-values ranging from 26.94 to 36.06 implying that these factors were highly statistically significant in influencing supply chain process to affect supply chain performance of public universities in Kenya. The study concludes that information sharing aids in achieving vital improvements for the supply chain members acts as a necessary tool for having an effective and competitive supply chain and allows the coordination of material flow and financial flow in the supply chain. The overall mean for information flow was 3.63. These scores indicate that the respondents agreed with the statements regarding aspects of information flow integration in their university to a great extent. This means that universities have to great extent integrated information flow.

4.6.2 Physical Flow Integration

Material management is essential for the efficient flow of raw materials and finished goods across the different departments including purchasing, warehousing, shipping and distribution. A well-coordinated flow of material enables firms to deliver products to end customers in a timely, efficient and effective way. The study sought to establish the influence of physical flow on supply chain performance of public universities, respondents were asked to indicate their response on a Likert type scale of 1(strongly disagree) to 5 (strongly agree) in the last five years on statements depicting physical flow. Table 4.11 gives the mean, standard of deviation and coefficient of variation, t- value and significance level on statements depicting physical flow in influencing of supply chain process integration capabilities on supply chain performance of public universities in Kenya.

Table 4.11: Physical Flow Integration

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
9.1	Movement of goods from source to customer influence supply chain integration	50	3.92	.90	0.23	30.80	.00
9.2	Integration of systems with suppliers influence supply chain integration	50	4.06	.89	0.22	32.25	.00
9.3	My university has an inventory management system integrated with our suppliers	50	3.10	1.18	0.38	18.54	.00

9.4	My university has supplier relationship management systems	50	3.26	1.27	0.39	18.08	.00
9.5	My university has customer relationship management systems	50	3.46	1.23	0.36	19.85	.00
9.6	My university has decision support management systems	50	3.42	1.31	0.38	18.45	.00
9.7	Supply chain process integration influences Information technology (IT) infrastructure	50	4.16	.91	0.22	32.27	.00
	Average Mean Score	50	3.63	1.10	0.31	24.32	0

The results in Table 4.11 gives the average mean on statements depicting physical flow in influencing supply chain management to affect SC performance of public universities was 3.63, SD = 1.10, CV 0.31, t = 24.32 and p = 0.00. This indicates that physical flow integration factors in the supply chain were highly significant to influencing supply chain performance of public universities. The statement that depicted the highest mean was supply chain process integration influences Information Technology (IT) infrastructure (Mean=4.16, SD=.91, CV=0.22).

Lately the concepts of supply chain design and management have become a popular operations paradigm. This has intensified with the advancement of Information and Communication Technologies (ICT) that include Electronic Data Interchange (EDI), the internet and World Wide Web (WWW) to overcome the ever-increasing complexity of the systems driving buyer–supplier relationships.

The complexity of supply chain management has also enforced companies to go for online communication systems. According to Graham & Hardaker (2017) internet increases the richness of communications through greater interactivity between the firm and the customer.

Integration of systems with suppliers influence supply chain integration (Mean=4.06, SD=.89, CV=0.22), Movement of goods from source to customer influence supply chain integration (Mean=3.92, SD=.90, CV=0.23), my university has customer relationship management systems (Mean=3.46, SD=1.23, CV=0.36), my university has decision support management systems (Mean=3.42, SD=1.31, CV=0.38). My university has supplier relationship management systems (Mean=3.26, SD=1.27, CV=0.39) and my university has an inventory management system integrated with our suppliers (Mean=3.10, SD=1.18, CV=0.38).

Integration of supply chain leads to high responsiveness to customers' demands, reduction in cycle time, transaction visibility, reduction in the operational costs and increased customer service levels (Alfalla-Luque, Medina-Lopez & Dey, 2013). All these results into high operational and firms' performance of the supply chain partners. Additionally, customers' integration is vital for the performance of the firms for it indicates the levels of demand and customer satisfaction level, and supplier integration is vital in product designing in order to ensure quality of the products are maintained hence influence the overall performance of the firm.

The study reports statistically significant results for factors depicting physical flow since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance. Additionally, these mentioned factors had t-values ranging from 18.084 to 32.268

indicating that these factors were highly statistically significant in the supply chain process to influence supply chain performance of public universities in Kenya.

4.6.3 Financial Flow Integration

The study sought to describe financial flow activities of the universities. Respondents were asked to indicate the extent to which they agreed that the statements of items of financial flow integration described their universities. Each item had a 5-point Likert-type scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5). The respondents were analyzed using mean scores, standard deviations and coefficient of variation. Higher mean scores indicated strong agreement on the item and lower mean score implied strong disagreement. Table 4.12 presents the results of the analysis.

Table 4.12: Financial Flow Integration

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
10.1	Integration facilitates the flow of funds in my university	50	3.82	.98	0.26	27.47	.00
10.2	My university applies e-invoicing	50	3.38	1.41	0.42	16.92	.00
10.3	My university applies e-payments	50	3.44	1.31	0.38	18.54	.00
10.4	Internal transfers are applied in my university	50	3.84	1.037	0.27	26.18	.00
	Average Mean Score	50	3.62	1.19	0.33	22.28	0

The average mean score of statement depicting financial flow integration in influencing supply chain performance of public universities was 3.62. This is a high mean indicating that financial flow integration in an organization greatly influences supply chain performance of the public universities. The average SD = 1.19; CV= 0.33; t = 22.28 and p = 0.00. A $p<0.05$ indicates that the factor is highly significant. Therefore, results of the findings indicated that financial flow was highly significant in influencing supply chain performance in public universities.

The statement with the highest mean was internal transfers are applied in my university (Mean=3.84, SD=1.04, CV=0.27). Other statements were Integration facilitates the flow of funds in my university (Mean=3.82, SD=.98, CV=0.26), my university applies e-payments (Mean=3.44, SD=1.31, CV=0.38) and my university applies e- invoicing (Mean=3.38, SD=1.41, CV=0.42). The study indicates statistically significant results for factors depicting financial flow since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance. Additionally, these mentioned factors had t-values ranging from 16.92 to 27.47 indicating that these factors were highly statistically significant in the supply chain process to influence supply chain performance of public universities in Kenya because of the high value of the t-value.

Generally, e-payments aid in minimizing expenses and cumbersomeness of time, distance as well as space in doing business and additionally yield better customer service, greater efficiency and higher profitability. Further, by tracking financial events through an automated financial system, management is able to exercise improved control over expenditure, improve transparency and accountability in the budget cycle as a whole (Modgil & Sharma, 2017).

The cash-to-cash cycle is an important factor in the context of managing financial flows. The importance of shortening the cash-to-cash cycle is represented by lowering financial costs to fund carrying out business operations. The cash-to-cash cycle is largely dependent on the supply chain capability. The effective flow of financial integration resources between the focal firms and its suppliers and customers results in shorter cash-to-cash cycle by reducing days-in-inventory, shortening days-in-receivables and extending days-in-payables.

4.7 Information Technology Infrastructure

The study sought to describe information technology infrastructure of the universities. The aspects of information technology infrastructure included internal infrastructure and external infrastructure. This section presents the results of descriptive statistics of the aspects of information technology infrastructure.

4.7.1 Internal Information Technology Infrastructure

Internal infrastructure integration is the degree of coordination between functions within the organization. Information technology provides opportunities for public universities to communicate with one another through email, mailing lists, chat rooms, and other systems. It also provides quicker and easier access to more extensive and current information, and it can be used to do complex mathematical and statistical calculations. Furthermore, it provides researchers with a steady avenue for the dissemination of research reports and findings. To establish how internal information technology infrastructure influenced supply chain performance in public universities, respondents were asked to indicate their response on a Likert type scale of 1(strongly disagree) to 5 (strongly agree) on statements depicting internal information technology.

Table 4.13 gives the mean, standard of deviation and coefficient of variation, t- value and significance level on statements depicting internal information technology infrastructure in influencing of supply chain process integration capabilities on supply chain performance of public universities in Kenya.

Table 4.13: Internal Information Technology Infrastructure

Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
Through ICT my university shares a sense of fair play with its customers	50	3.92	.83	0.21	33.43	.00
Through ICT my university frequently interacts with customers to set its reliability responsiveness and other standards	50	3.82	.83	0.22	32.73	.00
Through ICT my university frequently follows our customers for quality service feedback	50	3.66	.96	.26	26.94	.00
Through ICT my university frequently determines future customer expectations	50	3.52	.97	0.28	25.56	.00
Through ICT my university facilitates customers' ability to seek assistance from it	50	3.84	.91	0.24	29.79	.00
Through ICT my university periodically evaluates the formal and informal complaints of its customers	50	3.72	1.01	0.27	26.02	.00
Through ICT my	50	3.42	.99	0.29	24.39	.00

Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
university periodically evaluates the importance of its relationship with its Customers						
Through ICT my university contributes to the efficiency and effectiveness of our business processes	50	3.94	.93	0.24	29.80	.00
Through ICT my university enables university to break time barriers	50	3.90	.89	0.23	31.11	.00
Through ICT my university enables university to break cost barriers	50	3.94	.890	0.23	31.30	.00
Through ICT my university enables value addition to product/services	50	3.88	.94	0.24	29.19	.00
Through ICT my university provide rich data about customers and Competitor	50	3.86	.90	0.23	30.20	.00
Average Mean Score	50	3.79	0.92	0.25	29.20	0

The average mean score of statement depicting internal information technology infrastructure in influencing SC performance of public universities in Kenya was 3.79. This indicates that internal information technology infrastructure had a high influence on supply performance of public universities. The average standard of deviation was 0.92, coefficient of variation was 0.25, t- value of 29.20 and p-value of 0.00, hence implying a highly significant relationship between internal information technology infrastructure and supply chain performance in public universities.

The statements with the highest mean were through ICT my university contributes to the efficiency and effectiveness of our business processes (Mean=3.94, SD=.93481, CV=0.24) and Through ICT my university enables university to break cost barriers (Mean=3.94, SD=.89, CV=0.23).

As a tool for addressing challenges in teaching and learning, technology has capabilities for delivery, management, and support of effective teaching and learning. It is equally good for geographically dispersed audiences, and it also helps students to collect and make sense of complex data. IT also supports diverse and process–oriented forms of writing and communication, and it broadens the scope and timeliness of information resources available in the classroom. Also at the change agent, it catalyzes various other changes in the content, methods, and overall quality of teaching and learning, thereby ensuring constructivist inquiry-oriented classrooms, utilized in public universities.

Further, other statement that: through ICT my university shares a sense of fair play with its customers (Mean=3.92, SD=.83, CV=0.21), Through ICT my university enables university to break time barriers (Mean=3.90, SD=.89, CV=0.23), Through ICT my university enables value addition to product/services (Mean=3.88, SD=.94, CV=0.24), Through ICT my university provides rich data about customers and Competitor (Mean=3.86, SD=.90, CV=0.23), Through ICT my university facilitates customers' ability to seek assistance from it (Mean=3.84, SD=.91, CV=0.24). Through ICT my university frequently interacts with customers to set its reliability responsiveness and other standards (Mean=3.82, SD=.83, CV=0.22). Through ICT my university periodically evaluates the formal and informal complaints of its customers (Mean=3.72, SD=1.01, CV=0.27).

Through ICT my university frequently follows our customers for quality service feedback (Mean=3.66, SD=.96, CV=0.26) and through ICT my university frequently determines future customer expectations (Mean=3.52, SD=.97, CV=0.28).

A high level of IT infrastructure enables firms to design metrics and analytics to provide visibility into the real-time performance of various processes, the integration between the various processes and advance warnings about performance degradation in processes. Further, Han, Wang & Naim, (2017) argue that high level of IT infrastructure capability enables faster and more responsive redesign and reconfiguration of processes in responses to changes in business conditions. Narasimhan *et al.* (2010) argue that external and internal supply chain practices might impact each other as firms might benefit from resources, particularly knowledge, generated within or outside the firm. The benefits of transferring new ideas include improved inventory management, higher sales and better understanding of demand. The statement with the lowest mean was through ICT my university periodically evaluates the importance of its relationship with its Customers (Mean=3.42, SD=.99, CV=0.29). Despite this low score, Ravichandran (2018) argued that capability building processes and actions in firms tie IT infrastructure capabilities with the development of customer management capability.

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 (Deepak & Saji, 2016). From researcher's perspective, an integrated IT infrastructure enables consistent and real-time transfer of information between SCM-related applications and functions that are distributed across partners.

Such integrated IT infrastructures for SCM can be blended with inter-organizational processes to develop higher-order capabilities for demand sensing, operations and workflow coordination, and global optimization of resources.

The study indicated statistically significant results for factors depicting internal information technology infrastructure since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance. Additionally, these mentioned factors had t-values ranging from 24.39 to 33.43 indicating that these factors were statistically significant in the supply chain process to influence performance of public universities in Kenya because of the high value of the t-value. As a central force in economic competitiveness, IT deals with economic and social shifts that have technology skills critical to future employment of today's students. Looking at the role of education in the development of any society, the institution was indispensable in developing an ICT culture of any country. The institution must therefore provide effective leadership in ICT integration, through research, modeling of effective integration of ICT, and provision of opportunities for professional development of citizens of a country.

4.7.2 External Information Technology Infrastructure

External information technology infrastructure in the study was depicted as an aid of ICT in the optimization of the supply chain process with external firms. To establish this, respondents were asked to indicate their response on a Likert scale of 1(strongly disagree) to 5 (strongly agree) in the last five years on statements depicting external information technology.

Table 4.14 gives the mean, standard of deviation and coefficient of variation, t- value and significance level on statements depicting external information technology infrastructure in influencing of supply chain process integration capabilities on SC performance of public universities in Kenya.

Table 4.14: External Information Technology Infrastructure

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
12.1	Through ICT my university can optimize the supply chain processes with external firms	50	3.92	.85	0.22	32.48	.00
12.2	Through ICT my university can effectively transact with our external firms through standardized information format e.g. Excel, PDF, HTML, EDI)	50	4.12	.85	0.21	34.33	.00
12.3	Through ICT my university can effectively access our information technology network properly and securely to communicate with external firms (e.g. internet/LAN access anytime anywhere)	50	4.20	.83	0.20	35.65	.00
12.4	Through ICT my university can effectively transact with external firms by using our advanced hardware (e.g. Computer, field devices, sensors, meters, servers etc.)	50	4.12	.77	0.19	37.69	.00
12.5	Through ICT my university can effectively transact with external firms by using our	50	4.10	.81	0.20	35.60	.00

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
	advanced software and applications (e.g. Logistics portals, email systems, etc.)						
12.6	Through ICT my university can easily build and alter our information linkages to our existing supply chain partners (e.g. customers, suppliers and third-party logistics providers in response to changes in the business environment)	50	3.96	.81	0.20	34.69	.00
12.7	Through ICT we can easily build and alter our information linkages to new supply chain partners	50	3.90	.86	0.22	31.95	.00
12.8	Through ICT my university strives to establish long-term relationship with suppliers	50	3.90	.91	0.23	30.33	.00
12.9	Through ICT my university includes key suppliers in its planning and goal setting	50	3.54	.95	0.27	26.29	.00
12.10	Through ICT my university actively involves its key suppliers in new product development	50	3.50	.95	0.27	25.97	.00
	Average Mean Score	50	3.93	0.86	0.22	32.50	0

The results in Table 4.14 give the average mean on statements depicting external information technology infrastructure in influencing supply chain management to affect supply chain performance in public universities as 3.93, standard of deviation of 0.86, coefficient of variation of 0.22, t-value of 32.50 and p-value of 0.00. This indicates that external information technology factors in the supply chain were highly significant to influence SC performance of public universities. The statement that depicted the highest mean was Through ICT my university can effectively access our Information Technology network properly and securely to communicate with external firms (e.g. internet/LAN access anytime anywhere) (Mean=4.20, SD=.83, CV=0.20).

Flexible Information Technology infrastructure (IT) can simultaneously deliver rapid results and support sustainable growth in an increasingly dynamic market environment; while inflexible IT could have detrimental effects on organizational performance – for instance, freezing the organization into patterns of behavior and operations that resolutely resist change (Han, Wang & Naim, 2017). Information Technology infrastructure flexibility has a critical impact on firm's ability to manage its supply chains when operating under conditions of high environment munificence, dynamism and complexity.

Other statements were Through ICT my university can effectively transact with our external firms through standardized information format e.g. Excel, PDF, HTML, EDI) (Mean=4.12, SD=.85, CV=0.21), Through ICT my university can effectively transact with external firms by using our advanced hardware (e.g. Computer, field devices, sensors, meters, servers etc.) (Mean=4.12, SD=.77, CV=0.19),

Through ICT my university can effectively transact with external firms by using our advanced software and applications (e.g. Logistics portals, email systems, etc.) (Mean=4.10, SD=.81, CV=0.20), Through ICT my university can easily build and alter our information linkages to our existing supply chain partners (e.g. customers, suppliers and third party logistics providers in response to changes in the business environment) (Mean=3.96, SD=.81, CV=0.20). Through ICT my university can optimize the supply chain processes with external firms (Mean=3.92, SD=.85, CV=0.22), Through ICT we can easily build and alter our information linkages to new supply chain partners (Mean=3.90, SD=.86, CV=0.22), Through ICT my university strives to establish long-term relationship with suppliers (Mean=3.90, SD=.91, CV=0.23) and through ICT my university includes key suppliers in its planning and goal setting (Mean=3.54, SD=.95, CV=0.27).

With the advancement of information and communication technologies, supply chain integration has been considered a strategic tool for firms to improve their competitiveness. The supply chain integration within processes and between organizations has enhanced value creation. ICT impacts both internal process integration by increasing the flow of relevant information among process participants and external integration with suppliers and customers by forging closer supplier and customer relationship. The statement with the lowest mean however was Through ICT my university actively involves its key suppliers in new product development (Mean=3.50, SD=.95, CV=0.27). The study indicates statistically significant results for factors depicting external information technology infrastructure since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance.

Additionally, these mentioned factors had t-values ranging from 25.97 to 37.69 indicating that these factors were statistically significant in the supply chain process to influence SC performance of public universities in Kenya because of the high t-value.

The overall mean for information technology infrastructure was 3.89 and 3.93 for internal and external infrastructure respectively. This score indicates that the respondents strongly agreed with the statements regarding the items of the dimensions of internal infrastructure and external infrastructure. These results show that the information technology infrastructure in public universities support the integrative capabilities to a great extent. However, the mean score for the internal integration is relatively low (3.89), which is interpreted to mean that there is less internal infrastructure integration in the universities as compared to external infrastructure.

4.8 Government Policy

The study sought to describe government policy in public universities. The aspects of government policy included procurement law and procurement procedures. This section presents the results of descriptive statistics of the aspects of government policy

4.8.1 Procurement Law

To establish the moderating effect of government policy on the relationship between supply chain process integration capabilities and supply chain performance in public universities in Kenya, the respondents were asked to indicate their response on a Likert scale of 1(strongly disagree) to 5 (strongly agree) on statements depicting government policy.

Table 4.15 gives the mean, standard of deviation and coefficient of variation, t- value and significance level on statements depicting government policy in influencing of supply chain process integration capabilities on SC performance of public universities in Kenya

Table 4.15: Government Policy

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
13.1	In my university public procurement policy enables public private partnership procurement	50	3.88	1.04	0.27	26.31	.00
13.2	Public Procurement allows my university to do joint procurements with other universities	50	3.52	1.0	0.30	23.60	.00
13.3	In my university public procurement enables collaborations with other universities	50	3.50	1.11	0.32	22.27	.00
13.4	In my university we comply with Public Procurement Act to the letter	50	4.00	1.14	0.29	24.75	.00
	Average Mean Score	50	3.73	1.09	0.30	24.23	0

The results in Table 4.15 give the average mean on statements depicting government policy in influencing supply chain management to affect SC performance in public universities was 3.73, standard of deviation of 1.09, coefficient of variation of 0.30, t-value of 24.23 and p-value of 0.00. This indicates that government policy factors in the supply chain were highly significant to influence SC performance of public universities. The statement that depicted the highest mean was in my university we comply with public procurement Act to the letter (Mean=4.00, SD=1.14, CV=0.29). This is supported by the fact that the Act establishes procurement and disposal procedures, and set up the necessary structures to ensure that the procedures are followed and there is provision of oversight and compliance. Other statements were in my university public procurement policy enables public private partnership procurement (Mean=3.88, SD=1.04, CV=0.27),

Public Procurement allows my university to do joint procurements with other universities (Mean=3.52, SD=1.054, CV=0.30) and in my university public procurement enables collaborations with other universities (Mean=3.50, SD=1.11, CV=0.32).

The study further indicated statistically significant results for factors depicting government policy since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance. Additionally, these factors had t-values ranging from 22.27 to 26.31 indicating that the factors were statistically significant in the supply chain process to influence SC performance of public universities in Kenya because of the high value of the t-value.

Adopting an efficient public procurement system improves procurement performance, the performance of the procuring entity and at the national level assists policy makers to understand how various policy goals interact and how policy impacts on the overall performance of the procurement system. It enables governments and parliaments to improve the quality of decision making and to take constructive and long-term actions that will most effectively develop their public procurement systems. Creates stronger incentives on governments to improve their public procurement systems, and helps them to set priorities for reform actions in the area of public procurement to monitor progress against the objectives. Set and provide valuable information for the assessment of the public expenditure system (Hardy & Williams, 2011). It is the duty of the government to lay out procurement policy which is simply refers to the rules and regulations that are set in place to govern the process of acquiring goods and services needed by organizations to function efficiently.

This policy is created to maximize economy and efficiency, promote competition and ensure that competitors are treated fairly, promote the integrity and fairness of procurement procedures, increase transparency and accountability in those procedures, increase public confidence in those procedures, facilitate the promotion of local industry and economic development.

With an average mean of 3.73 the score indicates that the respondents strongly agreed with the statements regarding the items of the dimensions of procurement law. This means that to a great extent the universities are complying with the public procurement law.

4.8.1 Procurement Procedures

Effective public procurement systems are systems that are defined as offering a high level of transparency, accountability and value for money in the application of a procurement budget. High level of compliance with procurement regulations, transparency and accountability of procurement funds increases the level of effectiveness in procurement practices in public training institutions. The study looked into procurement procedures in terms of acquiring goods, service, works, asset disposal that are satisfactory as well as to establish the most common procuring method applied in the public universities. To establish these facts, respondents were asked to indicate their response on a Likert type scale of 1(strongly disagree) to 5 (strongly agree) in the last five years on statements depicting procurement procedures. Table 4.16 gives a summary of the findings.

Table 4.16: Procurement Procedures

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
14.1	In my university public procurement procedures in terms of acquiring goods, service and works are satisfactory	50	3.84	1.057	0.28	25.70	.00

14.2	In my university consider public procurement procedures in terms of asset disposal are satisfactory	50	3.86	.97	0.25	28.16	.00
14.3	In my university public procurement enables collaborations with other universities	50	3.48	1.07	0.02	22.92	.00
14.4	In my university open tendering is the most common method used for procuring	50	3.82	1.02	0.27	26.38	.00
	Average Mean Score	50	3.75	1.03	0.20	25.79	0

The average mean score of statement depicting procurement procedures in influencing SC performance of public universities in Kenya was 3.75. This indicates that procurement procedures had a high influence on SC performance of public universities. The average standard of deviation was 1.03; coefficient of variation was (0.20), t- value of 25.79 and p-value of 0.00, hence implying a highly significant relationship between procurement procedures and SC performance in public universities. The statement with the highest mean was in my university we consider public procurement procedures in terms of asset disposal as satisfactory (Mean=3.86, SD=.97, CV=0.25). Other statements were in my university public procurement procedures in terms of acquiring goods, service and works are satisfactory (Mean=3.84, SD=1.06, CV=0.28).

In my university open tendering is the most common method used for procuring (Mean=3.82, SD=1.02, CV=0.27) and in my university public procurement enables collaborations with other universities (Mean=3.48, SD=1.07, CV=0.02). Open tenders, which the study established as the common procedure adopted by the surveyed public universities is where prospective suppliers are invited to compete for a contract advertised in the press and the lowest tender in terms of price is generally accepted although the

advertisers usually state that they are not bound to accept the lowest or any tender. Methods and strategies commonly used by universities and governments to plan purchases more effectively include consolidation of requirements, term contracting, delegation of purchasing authority and value analysis.

By consolidating their requirements internally and sometimes with other entities, government increases its buying power and thus, obtains better pricing and services. These findings are congruent with observations by (Ojo & Gbadabo.2014: Hermanson, Justice, Ramamoorti, & Riley, 2017) who confirmed that the internal controls at an institution affect compliance with public procurement laws while weak internal controls may lead to increasing non-compliance and loss of substantial public revenue

4.9 Supply Chain Performance

The study sought to describe the supply chain performance of public universities. The aspects of supply chain performance included internal operational dimensions and customer service dimensions. Each item had a 5-point Likert-type scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5). The responses were analyzed using mean scores, standard deviations and coefficient of variation. Higher mean scores indicated strong agreement on the item and lower mean score implied strong disagreement.

4.9.1 Internal Dimension Process Flexibility

Internal process dimension flexibility is a firm's ability to respond quickly and efficiently to changing customer needs and preferences. With supply chain flexibility, a firm can delay commitment, embrace change as well as fine tune delivery to meet specific customer needs and requirements.

The study established internal dimension process flexibility as the public universities ability to respond to demand variations, poor supplier performance, poor delivery performance and accommodation of new products, new markets as well as new competition. To establish these facts, respondents were asked to indicate their response on a Likert type scale of 1(strongly disagree) to 5 (strongly agree) in the last five years on statements depicting procurement procedures. Table 4.17 gives a summary of the findings.

Table 4.17: Internal Dimension Process Flexibility

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
15.1	My university has the ability to respond to and accommodate demand variations	50	3.76	.74	0.20	35.74	.00
15.2	My university has the ability to respond to and accommodate the periods of poor supplier performance	50	3.70	.76	0.21	34.31	.00
15.3	My university has the ability to respond and accommodate periods of poor delivery performance	50	3.78	.76	0.20	35.00	.00
15.4	My university has the ability to respond and accommodate new products, new markets or new competition	50	3.94	.79	0.20	35.13	.00
	Average Mean Score	50	3.80	0.77	0.20	35.04	0

The results in Table 4.17 gives the average mean on statements depicting internal dimension process flexibility in influencing supply chain management to affect SC performance in public universities was 3.80, standard of deviation of 0.77, coefficient of variation of 0.20, t-value of 35.04 and p-value of 0.00.

This indicates that internal flexibility factors in the supply chain were highly significant to influencing SC performance of public universities. The statement with the highest mean was my University has the ability to respond and accommodate new products, new markets or new competition (Mean=3.94, SD=.79, CV=0.20). As environmental diversity and uncertainty increases, firms respond by adding flexibility as a dimension to their operation strategies. Flexibility improves company's competitiveness, particularly for the decision-making process of implementing technologies.

According to Oh *et al*. (2015) supporting complicated new product development procedures is important for total production process and maintaining product quality in supply chain. Melander (2014) argued that companies collaborate with suppliers in new product development in order to get access to new or advanced technology that the suppliers may have. Such technological integration may open new opportunities for the buying firm in designing and developing new products by incorporating the supplier's technology as complementary to internal technology (Wisner, Tan & Leong, 2016;

Flexibility hence is an important source of competitive advantage and therefore positively affects the business performance. Other statements were My University has the ability to respond and accommodate periods of poor delivery performance (Mean=3.78, SD=.76, CV=0.20), my university has the ability to respond to and accommodate demand variations (Mean=3.76, SD=.74, CV=0.20) and my university has the ability to respond to and accommodate the periods of poor supplier performance (Mean=3.70, SD=.76, CV=0.21). One strategy for gaining and maintain a competitive advantage in a dynamic environment is to create a flexible organization. Flexibility is the organization's ability to meet an increasing variety of customer expectations without excessive costs, time, organizational disruptions, or performance losses.

In order to be useful in achieving company objectives, flexibility should be viewed from a value chain perspective (satisfying customer needs) rather than from an equipment or process perspective. Additionally, this notion reflects the ability to stay operational in changing conditions, whether they are predictable or not, completely different or not from conditions known in advance. This adaptability is required from firms that, for economic reasons, are currently turning to efficient techniques of organization and management of the zero stock, just-in-time and tight-flow type which can make them fragile. Competition amplifies the development of the market by creating new situations.

4.9.2 Cost Leadership

Cost Leadership is a strategy used by businesses to create a low cost of operation within their niche with the primary objective of gaining advantage over competitors. This is achieved by reducing operating costs below that of others in the same industry. Cost leadership strategy is usually developed around organization-wide efficiency, therefore for firms implementing the cost leadership strategy to maintain a strong competitive position and sustain their profit margin for a considerable period of time. They have to place a premium on efficiency of operations in all functional areas (Matopoulos, Barros & Van der Vorst, 2015). The study established cost leadership in terms of production cost, inventory cost, unit cost, labour productivity and return of investments. Table 4.18 summarizes the findings of the study.

Table 4.18: Cost Leadership

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
16.1	My university optimizes on total costs associated with delivery, return on investments	50	3.78	.737	0.19	36.29	.00
16.2	Produce materials/components/ products at low cost	50	3.58	.91	0.24	27.96	.00
16.3	Reduce production cost	50	3.82	.85	0.22	31.79	.00
16.4	Reduce inventory cost	50	3.74	.92	0.25	28.70	.00
16.5	Reduce unit cost	50	3.88	.90	0.24	29.74	.00
16.6	Increase labor productivity	50	3.88	.87	0.22	31.45	.00
	Average Mean Score	50	3.77	0.86	0.23	30.99	0

The average mean score of statement depicting cost leadership in influencing SC performance of public universities in Kenya was 3.77. This indicates that cost leadership had a high influence on SC performance of public universities. The average standard of deviation was 0.86; coefficient of variation was 0.23, t- value of 30.99 and p-value of 0.00, hence implying a highly significant relationship between cost leadership and SC performance in public universities. The statement with the highest mean was Increase labor productivity (Mean=3.88, SD=.87, CV=0.22) and the statement with the lowest mean was Produce materials/components/products at low cost (Mean=3.58, SD=.91, CV=0.24).

The reason for applying the strategy on cost leadership is to obtain the advantage by reducing economic costs amongst its competitors (Matopoulos, Barros & Van der Vorst, 2015).

This strategy highlights efficiency by producing qualified and standardized products or services, at the same time, with economies of scale and experience curve, the firm strives to gain sustainable competitive advantage among its competitors. Cost leadership further aids firms in producing the standard, high volume product or service at the most competitive price to customers. By stressing on a cost leadership strategy, universities are able to largely create higher financial performance through competing in emerging economies, as firms can gain a relative advantage because of their lower costs in labor recourse and manufacturing. The study further indicated statistically significant results for factors depicting cost leadership since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance.

Additionally, these mentioned factors had t-values ranging from 28.00 to 36.29 indicating that these factors were statistically significant in the supply chain process to influence supply chain performance of public universities in Kenya because of the high value of the t-value. By renovating best practice organizational procedures, together with careful observing purchasing expenditures, application of computer and communications technology in a cost-effective manner, trimming of overhead cost, and efficient operations, a firm can achieve the cost reduction. If public universities are able to achieve and sustain overall cost leadership, then they should be sure of an above average performance in the industry.

4.9.3 Delivery Reliability

Delivery reliability is the ability to reduce the time between order receipt and customer delivery to as close to zero as possible. It integrates production lead-time, which refers to the time between ordering a good, or a service and receiving it. This will give customers realistic estimates on how fast their order was filled. Delivery reliability in this study was captured as provision on- time, fast and reliable delivery. Respondents were asked to indicate their response on a Likert type scale of 1(strongly disagree) to 5 (strongly agree) in the last five years on statements depicting delivery reliability. Table 4.19 gives a summary of the findings.

Table 4.19: Delivery Reliability

No.	Statement	N	Mean	Std. Deviation	Coefficient of variation	t	Sig. (2-tailed)
17.1	Supply chain integration allows my university to facilitate time breaks	50	3.88	.80	0.21	34.34	.00
17.2	Supply chain integration allows my university to facilitate real-time deliveries	50	3.76	.80	0.21	33.36	.00
17.3	Provide materials components/products that are highly reliable	50	3.74	.72	0.19	36.57	.00
17.4	Provide fast delivery	50	3.76	.98	0.26	27.11	.00
17.5	Provide on-time delivery	50	3.62	1.05	0.29	24.43	.00
17.6	Provide reliable delivery	50	3.80	.86	0.23	31.35	.00
17.7	Decrease lead time	50	3.90	.81	0.21	33.86	.00
	Average Mean Score	50	3.78	0.86	0.23	31.56	0

The average statement of statements depicting delivery reliability was 3.78, standard deviation of 0.86, coefficient of variation of 0.23, t-value of 31.56 and significance level of 0.00.

This portrays a strong relationship existing between delivery reliability and performance of public universities in Kenya. The statement with the highest mean was Decrease lead time (Mean=3.90, SD=.91, CV=0.24). Delivery performance can be defined as the level up to which products and services supplied by an organization meet the customer expectation. It provides an indication of the potentiality of the supply chain in providing products and services to the customer. This metric is most important in supply chain management as it integrates (involves) the measurement of performance right from supplier end to the customer end.

In order to gain competitive advantages and efficiency improvements that include reduced inventory and higher delivery reliability, firms need to introduce information exchange systems which communicate demand to suppliers as well as production progress information to customers in the network (Kumar & Kushwaha, 2018). The study further indicated statistically significant results for factors depicting cost leadership since each statement had a p-value of 0.00. A $p<0.05$ depicts statistical significance. Additionally, these mentioned factors had t-values ranging from 24.43 to 36.57 indicating that these factors were highly statistically significant in the supply chain process to influence supply chain performance of public universities in Kenya because of the high value of the t-value.

4.9.4 Customer Service Dimension

Customer service dimension describes a company-wide business strategy including customer-interface departments as well as other departments. Measuring and valuing customer relationships is critical to implementing this strategy.

Elevating customer relationships would mean advancing through levels of customer service to customer satisfaction, to customer success.

Respondents were asked to indicate their response on a Likert type scale of 1(strongly disagree) to 5 (strongly agree) in the last five years on statements depicting customer service dimension. Table 4.20 gives the mean, standard of deviation and coefficient of variation, t- value and significance level on statements depicting customer service in supply chain process integration capabilities in influencing supply chain performance of public universities in Kenya.

Table 4.20: Customer Service Dimension

No.	Statement	N	Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
18.1	There is improvement in terms of speed of operations in my university due to supply chain process integration	50	4.00	.88	0.22	32.12	.00
18.2	My university's level of service provided to customers has improved	50	3.94	.82	0.21	34.04	.00
18.3	There is improvement in terms of quality of service/product in my university due to supply chain process integration	50	3.98	.82	0.21	34.30	.00
18.4	There is improvement in the quality of service/products to our customers due to Supply chain process integration	50	4.02	.82	0.20	34.65	.00
	Average mean score	50	3.985	3.985	0.83 0.83496	0.21 0.21	33.81 33.778	0	0

The average mean of the statements depicting customer service dimensions was 3.99. This is a high mean indicating that customer service highly influenced performance of a firm.

The statement with the highest mean was there is improvement in the quality of service/products to our customers due to Supply chain process integration (Mean=4.02, SD=.82, CV=0.20).

Customer service is a basic prerequisite of service to customers before, during and after a purchase. It includes the series of activity which helps to design a product or service that meet with the customer expectation and enhances the level of customer satisfaction (Masudin, Kamara, Zulfikarijah & Dewi, 2018). A good supply chain design helps in the relationship between customer & supplier, lowering costs, better coordination and improved customer service. Other statements were there is improvement in terms of speed of operations in my university due to supply chain process integration (Mean=4.00, SD=.88, CV=0.22),

There is improvement in terms of quality of service/product in my university due to supply chain process integration (Mean=3.98, SD=.82, CV=0.21) and My university's level of service provided to customers has improved (Mean=3.94, SD=.82, CV=0.21). It is also a pointer that fostering customer relationships through real time interaction can lead to better customer care through information sharing and strength of the relationship between partners. The study therefore summarizes that supply chain management in public entities aids in improving product quality, timely delivery, and integration with logistics functions to deliver improved customer service.

4.10 Tests of Hypotheses

This section presents and discusses the results of the hypotheses as derived from the specific objectives of the study. The study determined the effect of supply chain process integration capabilities on supply chain performance of public universities in Kenya.

The study further sought to establish the mediating effect of information technology infrastructure on the relationship between supply chain process integration and supply chain performance of public universities in Kenya and determine the moderating effect of government policy in the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

Six hypotheses were formulated and tested using; simple linear regression analysis for hypothesis one. Hierarchical regression analysis for the moderating effect, the four steps approach proposed by Memon et al. (2018) to test the mediating effect and multiple regression tested the combined effect exhibited by hypothesis four. These hypotheses were tested at 95 percent confidence level (α=0.05), hence decision points to reject or fail to reject a hypothesis were based on the p-values. Where $p<0.05$, the study failed to reject the hypotheses, and where $p>0.05$, the study rejected the hypotheses.

Interpretations of results and subsequent discussions also considered correlations (R), coefficients of determinations R^2, F-Statistic values (F) and beta values (β). R^2 indicated the change in dependent variable explained by change in the independent variables combined. Further, the higher the F-Statistic, the more significant the model was. The negative or positive effect of the independent variable on the dependent (either negative or positive) was explained by checking the beta (β) sign. The R-value shows the strength of the relationship between the variables, t-values represent the significance of individual variables. The findings were presented in various sections of this chapter along study objectives and corresponding hypotheses and towards the end of the chapter, a discussion of the results within the context of theory and empirical literature.

4.10.1 Supply Chain Process Integration Capabilities and Supply Chain Performance of Public Universities in Kenya

The study sought to establish the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya. The hypothesis was; H_{01}**:** Supply chain process integration capabilities have no significant influence on supply chain performance of public universities in Kenya and $H_{1:}$ Supply chain process integration capabilities have a significant influence on the supply chain performance of public universities in Kenya. In order to establish the statistical significance of these hypotheses, simple and multiple regression analysis were employed. The results were as presented in Table 4.21.

Table 4.21: Overall Regression Results of Supply Chain Process Integration Capabilities and Supply Chain Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Supply Chain process integration capabilities	.584[a]	.341	.327	.45403

a) ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
Supply Chain process integration capabilities	Regression	5.115	1	5.115	24.812	.000[b]
	Residual	9.895	48	.206		
	Total	15.010	49			

b) Combined coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.924	.386		4.991	.000
Supply Chain process integration capabilities	.522	.105	.584	4.981	.000

a. Predictors: (Constant), Supply chain process integration capabilities
b. Dependent Variable: Supply chain performance

The results in Table 4.21 indicate that there is a relatively positive significant association between supply chain process integration capabilities and supply chain performance R=.584. The coefficient of determination R^2 =.341 implies that supply chain process integration capabilities explains 34.1% of the variation in supply chain performance. The other variables not in the study model explain the remaining 65.9%. This is an indicator of moderate influence of supply chain process integration capabilities on supply chain performance. The analysis from the model had the F value of 24.8129, with p-value .000< 0.05, while the results of the beta coefficient showed that a unit increase in supply chain process integration capabilities will cause a .522 increase in supply chain performance (B=.522, t=4.981, p<0.05).

This implies that supply chain process integration capabilities are good predictors of supply chain performance among ICT and procurement departments among public universities in Kenya. This finding was sufficient to support the influence of supply chain process integration capabilities on supply chain performance. Therefore, the null hypothesis H_{01}: Supply chain process integration capabilities have no significant influence on supply chain performance of public universities in Kenya was rejected. The conceptual hypothesis H_1**:** Supply chain process integration capabilities have significant influence on supply chain performance of public universities in Kenya was accepted. The regression equation can be written as follows;

Y = 1.924+ .522 SCPIC,

Where

Y = Supply chain performance,

SCPIC= Supply chain process integration capabilities.

4.10.2 Supply Chain Process Integration Capabilities and Information Technology Infrastructure

The study sought to establish the influence of supply chain process integration capabilities on information technology infrastructure. The following hypotheses were formulated: $H_{02:}$ supply chain process integration capabilities have no significant influence on information technology infrastructure in public universities in Kenya and $H_{2:}$ Supply chain process integration capabilities have a significant influence on information technology infrastructure in public universities in Kenya. The composite index was computed for both the variables attributes and the hypothesis tested through simple linear regression analysis. The results showed a significant relationship between supply chain process integration capabilities (independent variable) and information technology infrastructure. The results were as presented in Table 4.22.

Table 4.22: 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 4.22 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 supply chain process integration capabilities increase its ability to put in place IT infrastructure increases 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 hypothesis H_{02}**:** Supply chain process integration capabilities have no significant influence on information technology infrastructure in public universities in Kenya was rejected. The alternate hypothesis H_2: Supply chain process integration capabilities have a significant influence on information technology infrastructure in public universities in Kenya was supported.

The regression equation can thus be written as follows:

Y = 1.844+ .553 SCPIC

Where Y = Information technology infrastructure,

SCPIC= Supply chain process integration capabilities.

4.10.3 Information Technology Infrastructure and Supply Chain Performance of Public Universities in Kenya

The study sought to establish the influence of information technology on supply chain performance of public universities in Kenya. This was hypothesised as $H_{03:}$Information technology infrastructure has no significant influence on supply chain performance of Public universities in Kenya and $H_{3:}$ Information technology infrastructure has a significant influence on the supply chain performance of public universities in Kenya.The composite index was computed for both the variables attributes and the hypothesis tested through simple linear regression analysis. The results were as presented in Table 4.23.

Table 4.23: Regression Results of Information Technology Infrastructure and Supply Chain Performance

a) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Information technology infrastructure	.657[a]	.431	.419	.42170

b) ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
Information technology infrastructure	Regression	6.474	1	6.474	36.406	.000[b]
	Residual	8.536	48	.178		
	Total	15.010	49			

c) Combined coefficients

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.

	B	Std. Error	Beta		
(Constant)	1.479	.392		3.771	.000
Information technology infrastructure	.608	.101	.657	6.034	.000

a. Dependent Variable: Supply chain performance
b. Predictors: (Constant), Information technology infrastructure

The results in Table 4.23 show (R= .657) and a beta co-efficient of .608 implying that there exists a positive and strong relationship between information technology infrastructure and supply chain performance. Coefficient of determination R^2=.431 which indicates that information technology infrastructure influence supply chain performance by 43.1%. The relationship between information technology infrastructure and supply chain performance is statistically significant since p-value<0.05 P=.000 at 95% confidence level.

The F value is 36.406 which is higher than the p-value depicting significant model. Results of the coefficients show that a unit increase in information technology infrastructure will cause a .608 increase in supply chain performance. This implies that as information technology infrastructure increase supply chain performance increases according to the responses. The findings, thus, were sufficient to support the influence of information technology infrastructure on supply chain performance. Therefore, the hypothesis H_{03}**:** Information technology infrastructure has no significant influence on supply chain performance of public universities in Kenya was rejected. The alternate hypothesis H_3**:** Information technology infrastructure has a significant influence on supply chain performance of public universities in Kenya was accepted. The regression equation can thus be written as follows: Y = 1.479+ .608 ITI where, Y = Supply chain performance, ITI= Information Technology Infrastructure.

4.10.4 Mediating Effect of Information Technology Infrastructure on the Relationship between Supply Chain Process Integration and Supply Chain Performance

The study sought to determine the mediating effect of information technology infrastructure on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya through formulation of the following hypothesis: $H_{04:}$ Information technology infrastructure has no significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya and $H_{4:}$ Information technology infrastructure has a significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. According to Memon et al., (2018) a quad triple method can be used to test the mediation effect hypothesis using regression analysis.

Step one involved regressing supply chain process integration capabilities with supply chain performance. The process moves to step two if step one yields statistically significant results and if not significant, the process terminates and would be concluded that information technology infrastructure do not mediate the relationship between supply chain process integration capabilities and supply chain performance. In step 2 supply chain process integration capabilities was regressed against information technology infrastructure. If the results are significant, the process moves to step 3 because the necessary condition for mediating effect exist. In step three the influence of information technology infrastructure on supply chain performance is tested using a simple linear regression model.

A statistically significant effect of information technology infrastructure on supply chain performance is a necessary condition in testing for the mediating effect. Finally, Step four tested the influence of supply chain process integration capabilities on supply chain performance while controlling for the effect of information technology infrastructure. These tests were conducted using simple linear regression analyses. The influence of supply chain process integration capabilities on supply chain performance should not be statistically significant when information technology infrastructure is controlled. This is a necessary condition in testing for a mediating effect. Results from the four steps are presented in Table 4.24, 4.25, 4.26 and 4.27 respectively.

Step One**:** Supply chain process integration capability was regressed against supply chain performance. The results are presented in Table 4.24.

Table 4.24: Regression Results from the Test of the Effect of Supply Chain Process Integration Capabilities on Supply Chain Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Supply chain process integration capabilities	.584[a]	.341	.327	.45403

a) ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
Supply Chain process integration capabilities	Regression	5.115	1	5.115	24.812	.000[b]
	Residual	9.895	48	.206		
	Total	15.010	49			

b) Combined coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.924	.386		4.991	.000
Supply Chain process integration capabilities	.522	.105	.584	4.981	.000

a. Dependent Variable: Supply chain performance
b. predictor:(Constant), Supply chain process integration capabilities

The findings in Table 4.24 indicate a statistically strong and positive relationship between supply chain process integration capabilities and supply chain performance R=.584, Coefficient of determination R^2=.341 depicts that supply chain process integration capabilities explains 34.1% of supply chain performance. The F-value of 24.812 with p-value of 0.00 which is less than the level of significant 0.05, hence the model is statistically significant.

The results thus confirmed the first step of testing for the mediating effect of information technology infrastructure on the relationship between supply chain process integration capabilities and supply chain performance. The mediating testing then proceeded to step two that involved testing the influence of supply chain process integration capabilities on information technology infrastructure. The results of the tests are presented in Table 4.25.

Table 4.25: 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 presented in Table 4.25 indicate that supply chain process integration capabilities have a positive statistically strong relationship with information technology infrastructure R=.572.

Further the coefficient of variation R^2=.327 depicted that information technology infrastructure is explained by 32.7% of supply chain process integration capabilities. Further the F-value was 23.315 with P-value of .00 which is<0.05, hence the model is statistically significant. The results, therefore suggest that the second step of testing confirms the process of testing the mediating effect to move to step 3. In step Three information technology infrastructure was regressed against supply chain performance. The results for the step 3 are presented in Table 4.26.

Table 4.26: Regression Results of Information Technology Infrastructure and Supply Chain Performance

a) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Information technology infrastructure	.657[a]	.431	.419	.42170

b) ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
Information technology infrastructure	Regression	6.474	1	6.474	36.406	.000[b]
	Residual	8.536	48	.178		
	Total	15.010	49			

c) Combined coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.479	.392		3.771	.000
Information technology infrastructure	.608	.101	.657	6.034	.000

a. Dependent Variable: Supply chain performance
b. Predictors: (Constant), Information technology infrastructure

The results in Table 4.26 indicate that information technology infrastructure had a significant relationship with supply chain performance R=.657 with information technology infrastructure explaining 43.1% of supply chain performance R^2=.431 with remaining percent being explained by other factors not considered in the model. The analysis from the model had F-value of 36.406 with P-value of 0.00 which is less than the level of significance 0.05; hence the model is statistically significant.

Therefore, the condition in the third step in testing for a mediating effect was satisfied and therefore progressed to step 4 in testing for the mediating effect. Finally, Step four tested the influence of supply chain process integration capabilities on supply chain performance while controlling for the effect of information technology infrastructure. These tests were done using simple linear regression analysis. The influence of supply chain process integration capabilities on supply chain performance should not be statistically significant at α=.05 when information technology infrastructure is controlled. The relevant results are summarized in Table 4.27.

Table 4.27: Regression Results Depicting Mediating Effect of Information Technology Infrastructure on Supply Chain Process Integration Capabilities and Supply Chain Performance

(a) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.302[a]	.091	.094	.77199
2	.854	.730	.732	.04492

(b) ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.029	1	.029	14.193	0.231
	Residual	.065	49	.002		
	Total	.093	50			
2	Regression	059	2	.30	26.867	0.000
	Residual	.034	48	.001		
	Total	.093	50			

(c) Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.632	.694		3.794	.000
supply chain process integration capabilities	.218	.212	.099	1.029	.0406
Information technology infrastructure	.459	.087	.578	5.263	.041

a. Dependent Variable: Supply chain performance

The results in Table 4.27 show that when information technology is controlled supply chain process integration capabilities explain only 9.1% of the variation in supply chain performance R^2 =.091 which is not statistically significant p-value=.231 which is higher than 0.05 threshold at 95% confidence level. At model 2, information technology infrastructure adds significantly to the supply chain performance as the variation increased from .091 to .730 and p-value=.000. The results reveal that the variance explained by information technology infrastructure is insignificant (F=14.193, p-value=.231) and the significance was increased (F=26.867, p-value=.000) in the second model.

The results revealed that the regression coefficients for supply chain process integration capabilities increased from .218 to .459 when information technology infrastructure was added to the regression suggesting that information technology infrastructure may be exerting a mediating effect. Thus fulfilling the fourth step for testing for mediation that the influence of supply chain process integration capabilities on supply chain performance should not be statistically significant at α=.05 when information technology infrastructure is controlled. The null hypothesis that H_{04}: Information technology infrastructure has no significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya was rejected. The conceptual hypothesis H_4**:** Information technology infrastructure has significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya was accepted. This can imply that the attributes of information technology infrastructure in terms of internal and external integration are manifested in the public universities in Kenya to the extent of influencing the supply chain process integration capabilities and subsequent the supply chain performance.

4.10.5 Moderating Influence of Government Policy on the Relationship Between Supply Chain Process Integration and Supply Chain Performance of Public Universities in Kenya

The objective was to establish the moderating influence of government policy on the association between supply chain process integration capabilities and SC performance of public universities in Kenya.

The moderating effect was determined by testing the effect of the independent variable on the dependent variable when the moderator is introduced through the hypothesis: H_{05}: Government policy has no significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya and H_5: Government policy has a significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

The composite index was computed for both supply chain process integration capabilities, government policy and supply chain performance and the hypothesis tested through Hierarchical regression analysis. In step one, supply chain process integration capabilities were regressed on SC performance. In step two, supply chain process integration capabilities were regressed on government policy. In step three the interaction term between supply chain process integration capabilities and government policy was introduced. The moderation effect is confirmed when the effect of interaction term is statistically significant. The results were as presented in Table 4.28.

Table 4.28: Moderation Results of the Effect of Government Policy on Supply Chain Process Integration Capabilities and Supply Chain Performance

a) Model Summary

Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
1	Supply chain process integration capabilities	.439[a]	.192	.190	.61573	.104	1.856	3	47	.150
2	Supply chain process integration capabilities, Government policy	.523[a]	.274	.272	.58386	.281	4.634	2	48	.150
3	Supply chain process integration capabilities, Government policy interaction	.761[a]	.579	.578	.39456	.385	6.490	5	45	.000

b) ANOVA

Model			Sum of Squares	df	Mean Square	F	Sig.
1	Supply chain process integration capabilities	Regression	3.048	1	1.016	1.856	.030
		Residual	26.277	49	.547		
		Total	29.325	50			
2	Supply chain process integration capabilities, Government policy	Regression	14.961	2	4.980	8.823	.000
		Residual	22.007	48	.446		
		Total	28.967	50			
3	Supply chain process integration capabilities, Government policy interaction	Regression	14.349	5	1.794	6.490	.000
		Residual	14.975	45	.348		
		Total	29.325	50			

c) Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.803	.314		2.559	.013		
	Supply chain process integration capabilities	.360	. 086	.426	4.192*	. 000	.966	1.035
	Performance	.290	.106	.278	2.740*	.008	.966	1.035
2	(constant)	.740	.319		2.321*	.023		
	Supply chain process integration capabilities	.357	.086	.421	4.148*	.000	.964	1.037
	Government policy	.314	.108	.301	2.905*	.005	.925	1.081
3	Supply chain process integration capabilities and government policy interaction	.675	.068	-.354	-3.957*	.026	.958	1.044

a. Predictors: (Constant), Government policy, supply chain process integration capabilities

b. Predictors: (Constant), Government policy, supply chain process integration capabilities, interaction term between government policy and supply chain process integration capabilities

c. Dependent Variable: Supply chain performance

The results in Table 4.28 on the moderating effect of government policy on the association between supply chain process integration capabilities and supply chain performance was computed using three steps.

In model one the result shows that the relationship between supply chain process integration capabilities and supply chain performance was significant (R= .439[a,] R^2=0.192, P value<0.05). In model two (R= .523[a,] R^2=274, P-value<0.05) and in model three (R= .761[a,] R^2=0.579, P-value<0.05).

This suggests that there was a progressive increase in the value of the coefficient of variation in each step thus portraying an influence of government policy. Coefficient of determination (R^2=.0.579) implies that government policy influences the association between supply chain process integration capabilities and supply chain performance by 57.9%, suggesting a positive and strong moderating influence. The value of the interaction term (SCPIC*GP) had a significant influence (β= .675, P<0.05) thus confirming a moderation effect of government policy on the association between supply chain process integration capabilities and supply chain performance.

The study therefore rejects the null hypothesis H_{05}: Government policy has no significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. The conceptual hypothesis: H_5: Government policy has significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya was accepted. Hefu Ke, Wei & Hua (2016) used hierarchical regression analysis to test moderating effects of market orientation on the relationship between supplies chain integration and firm performance. The moderating equations for supply chain process integration capabilities, government policy and supply chain performance can thus be written as:

$Y = .803 + .360X_1$

$Y = .740 + .357X_1 + .314Z$

$Y = .803 + .360X_1 + .314\ X_2 + .675X_1Z$

Where : Y = Supply chain performance of public universities, X= Supply chain process integration capabilities; Z= Government policy; X_1 Z= Supply chain process integration capabilities and Government policy interaction.

4.10.6 Joint Effect of Supply Chain Process Integration Capabilities, Information Technology Infrastructure, Government Policy and Supply Chain Performance

The final objective was to determine the joint effect of supply chain process integration capabilities, Information technology infrastructure and Government policy on SC Performance and arising from this objective, the following hypothesis was formulated and tested – H_{o6}: The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is significantly different from their individual effects and H_6**:** Supply chain process integration capabilities, Information technology infrastructure and Government policy have a statistically significant joint effect on supply chain performance of public universities. The hypothesis was tested using both simple and multiple regression analysis. Simple regression was used to test for individual independent effects while multiple regression analysis was used to test for joint effects. In the regression model, SC performance was the dependent variable, while supply chain process capabilities, information technology infrastructure and government policies were predictor variables. The joint effect was then established by regressing supply chain process integration capabilities, Information technology infrastructure and Government policy on SC Performance. The results are presented in Table 4.29

Table 4.29: Regression Results of the Individual and Joint Effect of Supply Chain Process Integration Capabilities, Information Technology Infrastructure and Government Policy on Overall Supply Chain Performance

Model		R	R Square	Adjusted R Square	Std. Error of the Estimate
1	Supply chain process integration capabilities	.585[a]	.342	.340	.38402
2	Information technology infrastructure	.523[a]	.274	.272	.58386
3	Government policy	.580[a]	.336	.335	.55811
4	Joint- supply chain process integration capabilities, Information technology infrastructure, Government policy	.830	.688	.668	.39410

(a) ANOVA

Model			Sum of Squares	df	Mean Square	F	Sig.
1	Supply chain process integration capabilities	Regression	37.526	1	37.526	254.469	.000[a]
		Residual	72.260	49	.147		
		Total	109.786	50			
2	Information technology infrastructure	Regression	47.032	1	47.032	137.967	.000[b]
		Residual	124.768	49	.341		
		Total	171.800	50			
3	Government policy	Regression	57.795	1	57.795	185.546	.000[b]
		Residual	114.005	49	.311		
		Total	171.800	50			
4	Joint- supply chain process integration capabilities, Information technology infrastructure, Government policy	Regression	116.116	3	5.372	34.586	.000
		Residual	107.300	47	.155		
		Total	223.416	50			

model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	1.335	.108			12.333	.000
(Constant)	upply chain process integration capabilities	.473	.030		.585	15.952	.000
2	Constant	1.109	.170			6.522	.000
	Information technology infrastructure	.686	.058		.523	11.746	.000
3	Constant	1.614	.111			14.536	.000
	Government policy	.561	.041		.580	13.622	.000
4	(Constant)	1.656	.596	-2.778	.008		.008
	Joint- supply chain process integration capabilities, Information technology infrastructure, Government policy	.741	.188	.383 3.933	.000	.700	0.0429

a. Dependent Variable: supply chain performance

b. Predictors: (Constant), supply chain process integration capabilities, Information technology infrastructure, Government policy

The regression results presented in Table 4.29 show that the influence of supply chain process integration capabilities on supply chain performance was significant (R^2=0.342, F=254.46, P<0.05) implying that supply chain process integration capabilities explains 34.2% of variation in supply chain performance while the other 65.8% is explained by other factors not considered in the model. The regression of supply chain process integration capabilities on supply chain performance was significant with (P < 0.05) and F ratio (254.46). The co-efficient β is also significant (β = 0.473, t = 15.952, P < 0.05) suggesting that when supply chain process integration capabilities change by one per cent, it effects to a 47.3% change in supply chain performance. Further, information technology infrastructure also showed significant influence on supply chain performance (R^2=0.274, F=137.97, P<0.05) and strategy (R^2=0.336, F=185.546, P<0.05). This implies that both information technology infrastructure and government policy are significant in explaining supply chain performance in public universities in Kenya.

The test for joint effects was performed through a separate analysis to establish the combined influence of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance. The regression results in Table 4.29 show that the joint influence of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance was significant (R^2 =0.688, F= 34.586, P< 0.05).

The results suggest that jointly, supply chain process integration capabilities, information technology infrastructure and government policy explain (68.8%) of variation in supply chain performance, while the remaining 31.2% is explained by other factors not considered in the study.

The F ratio shows that the regression of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance is statistically significant at ($P < 0.05$). It is clear from the value of (R^2 =.668) and F ratio that the regression model was fit for use in the analysis.

The joint effect was thus different, higher and significant (R^2 =0.688, F= 34.586, P< 0.05) compared to the individual effects of individual variables. In view of this finding, the null hypothesis: H_{06}**:** The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is not significantly different from their individual effects was rejected. The conceptual hypothesis: H_6**:** The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is significantly different was accepted. Based on the results, the regression model for hypothesis four can be fitted as follows:

The generic model: $Y= \beta_0+\beta_1$ SCPIC $+\beta_2$ ITI$+ \beta_3$ GP $+ \varepsilon$

The empirical model: Y= 1.656+0.741SCPIC +0.188ITI +0.820GP

Where ;

Y= Supply Chain Performance

β_0 = constant (intercept)

β_1 β_2 β_3 = Beta Coefficient parameters to be determined

SCPIC= Supply Chain Process Integration Capabilities

ITI= Information Technology Infrastructure

GP= Government Policy

ε = Error term

This model suggests that even in the absence of all three activities - Supply Chain Process Integration Capabilities, information technology infrastructure and government policy public universities supply chain performance will perform by 1.656 units. However, for a unit increase in supply chain process integration capabilities, information technology infrastructure and government policy, public universities will perform by 0.741 units, 0.188 units and 0.820 units respectively, when all other factors are held constant.

From this regression model, it is thus evident that supply chain performance of public universities in Kenya is influenced to a high degree by the combination of the predictor variables; Supply chain process integration capabilities, information technology infrastructure and government policy, whose beta coefficients were all positive and statistically significant.

4.11 Discussion of Results

The following section discusses the results of this study in line with the research objectives and the hypotheses formulated. These were formulated based on existing conceptual and empirical literature and led to the development of the conceptual model which outlined the relationships between the variables. To test the hypotheses, regression analysis was used after conducting tests for statistical assumptions. The section further discusses the results of this study to show the extent to which the results are consistent or inconsistent with the results of past studies.

4.11.1 Supply Chain Process Integration Capabilities and Supply Chain Performance of Public Universities in Kenya

The first objective of the study was to determine the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya. Based on the first hypothesis the null hypothesis; H_{01}**:** Supply chain process integration capabilities have no significant influence on supply chain performance of public universities in Kenya was formulated and tested. In order to establish the statistical significance of this hypothesis, simple regression analysis was employed. Data analysis and interpretation of the questionnaire responses from Heads of Supply Chain Management and Heads of ICT departments revealed that supply chain integration capabilities influence the supply chain performance of public universities in Kenya. Therefore, the null hypothesis H_{01}: Supply chain process integration capabilities have no significant influence on supply chain performance of public universities in Kenya was rejected. The conceptual hypothesis H_1**:** Supply chain process integration capabilities have significant influence on supply chain performance of public universities in Kenya was accepted.

The current study established a positive and significant relationship between supply chain process integration capabilities and supply chain performance of public universities. R=.584 and the coefficient of determination (R^2) =.341 implying a relatively moderate association between supply chain process integration capabilities and supply chain performance and that supply chain process integration capabilities are good predictors of supply chain performance (β =.522, t=4.981, $p<0.05$).

These findings indicate that supply chain process integration capabilities have significant influence on supply chain performance of public universities in Kenya. This could be supported by the fact that supply chain process integration capabilities through information flow integration, physical flow integration and financial flow integration help universities to enhance their supply chain performance. The results are supported by various studies. Supply chain process integration capabilities as described by Chopra & Meindl, (2016) as the structuring of activities and processes to assist organizations develop, allocate and align resources to achieve distinctive capabilities to generate better performance and competitive advantage.

This study operationalized SCPIC as information flow integration, physical flow integration and financial flow integration. Barney, (1991) had long established through the Resource Based View that for organizations to attain a competitive advantage, they have to create resource bases that are Valuable, Rare, Inimitable and Non-substitutable (VRIN). This can help the organizations like public universities to create a niche through agile supply chain process integration capabilities in their supply chains. The findings of this study are consistent with the findings of the study by Cheruiyot, (2013) who indicated that the supply chain integration (both upstream and downstream) was positively associated with supply chain performance in terms of improving transport cost, distribution cost, raw material purchasing cost, asset turnover and inventory holding cost hence overall performance.

The findings of the current study also concur with the findings of Leuschner, Rogers and Charvet (2013) who determined that there was a positive and significant correlation between supply chain integration and firm performance. Similarly consisted with studies of (Lee, Chung, Lee, Gan & Chou, 2016; Hefu, Ke, Wei & Hua, 2016) confirmed that proper management of supply chain process integration capabilities enables partners of the supply chain to optimize their daily operations with an increased return to be shared among them. Kembro, Selviaridis & Naslund (2014) argue that information shared on a daily basis and related to sales, logistics activities such as delivery schedules, inventory levels, and production activities such as production schedules and order status helps reduce cycle time, inventory levels and improving service levels. Other studies such as Alfalla-Luque, Medina-Lopez & Dey (2013) argue that integration of supply chain leads to high responsiveness to customers' demands, reduction in cycle time, transaction visibility, reduction in the operational costs and increased customer service levels.

Modgil & Sharma (2017) emphasize that by tracking financial events through an automated financial system, management is able to exercise improved control over expenditure and to improve transparency and accountability in the budget cycle as a whole. The empirical findings from (Kumar et al., 2015) suggested that internal integration is the basis for achieving a successful external integration. However, their study was focused on studying supply chain integration in the cultural context of China. Generally, the empirical findings reinforce the current study findings that supply chain process integration capability is vital for supply chain performance.

Generally, the findings of this study support those from prior studies that information technology infrastructure mediates the relationship between supply chain integration capailies comprising information flow, physical flow and financial flow integration (Gunasekaran Subramanian & Rahman, 2015), customer integration and supplier integration (Wagner & Bode, 2014), and supply chain performance. However, this study focused only on supply chain process integration in terms of information, physical and financial flows integration. This study adds to the existing body of knowledge by showing that supply chain process integration capabilities influence supply chain performance of public universities.

4.11.2 Supply Chain Process Integration Capabilities on Information Technology Infrastructure in Public Universities in Kenya

The second objective of the study sought to establish the influence of supply chain process integration capabilities on information technology infrastructure. The second hypothesis of the study was; H_{02}**:** Supply chain process integration capabilities have no significant influence on information technology infrastructure in public universities in Kenya. Composite indices were computed for the two variables' attributes and the hypothesis tested through simple linear regression analysis. Data analysis and interpretation of the questionnaire responses from Heads of Supply Chain Management and Heads of ICT departments revealed that supply chain integration capabilities influence the information technology infrastructure of public universities in Kenya. The results showed a significant relationship between Supply chain process integration capabilities and Information technology infrastructure. Coefficient of determination R^2=.327 an influence of SC process integration capabilities on information technology infrastructure and statistically significant (β =.553, F=15.478, P=.000).

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 H_{02}: Supply chain process integration capabilities have no significant influence on information technology infrastructure in public universities in Kenya was rejected. The conceptual hypothesis H_2**:** 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). This finding is consistent with previous studies. A study by Han, Wang & Naim (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. These results confirm the argument from previous studies of Ravichandran (2018) who argued that capability building processes and actions in firms tie IT infrastructure capabilities with the development of customer management capability. The findings also concur with study of Kemboi & 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. Further Childerhouse, Luo, Basnet, Ahn, Lee & Vossen (2013) argues 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.

4.11.3 Information Technology Infrastructure and Supply Chain Performance in Public Universities in Kenya

The third objective of the study sought to establish the influence of information technology on supply chain performance of public universities in Kenya. The composite index was computed for both the variables attributes and the hypothesis tested through simple linear regression analysis. It was hypothesized that Information technology infrastructure has no significant influence on supply chain performance of public universities in Kenya. The results indicated coefficient of determination of R^2=.431 influence of information technology infrastructure on supply chain performance and statistically significant (β=.608, F=36.406, P=.000). Based on the results, the null hypothesis that information technology infrastructure has no significant influence on supply chain performance of public universities in Kenya was not rejected. The conceptual hypothesis that information technology infrastructure has a significant influence on supply chain performance of public universities in Kenya was supported.

The results are consistent with Deepak & Saji (2016) who argue that better information technology infrastructure capabilities enable firms to position their IT assets and data and information services to capture information about customers. With appropriate IT systems organizations can disseminate information to customers through the internet, virtual communities and personalized information channels.

The place of information technology infrastructure was also advocated for by the Collaborative Network Theory. Tina (2013), opines that the capability building processes and actions in firms tie information technology infrastructure capabilities with the development of customer management capability. Han, Wang & Naim (2017) contend further 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; another significant business partners and that a high level of IT infrastructure enables firms to design metrics and analytics to provide visibility into the real-time performance of various processes, the integration between the various processes and advance warnings about performance degradation in processes.

It is therefore expected that integrated information technology infrastructures for SCM can be blended with inter-organizational processes to develop higher-order capabilities for demand sensing, operations, workflow coordination and global optimization of resources. Technological capability is one of the fundamentals of a firm's competitive capability because it augments a firm's ability to apply technical knowledge in creating and delivering innovative product that consumer may value and thus affect the overall business performance and new product development performance of the firms. Technological ability enhances cross border relationships within the supply chain as part of sustaining competitive advantage.

There is adequate evidence that increasingly firms realize the importance of engaging in strategic collaborations to survive in the current business environment and therefore engage in developing inter firm relationships especially within the supply chain to create more effective links with their trading partners.

4.11.4 Mediating Effect of Information Technology Infrastructure on the Relationship between Supply Chain Process Integration Capabilities and Supply Chain Performance of Public Universities

The fourth objective of the study sought to establish whether information technology infrastructure mediates the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. It was hypothesized that the effect supply chain process integration capabilities on supply chain performance of public universities in Kenya is not mediated by information technology infrastructure. When information technology is controlled R^2 =.091 which is not statistically significant (p-value=.091 which is greater than 0.05 threshold at 95% confidence level. At model 2, information technology infrastructure is not significant to the supply chain performance variance explained by IT infrastructure is insignificant (F=14.193, p-value=.231 which is greater than 0.05 threshold). The results of the study show that all the conditions for full mediation were met and hence the results supported the conceptual hypothesis that information technology infrastructure mediates the effect of supply chain process integration capabilities on supply chain performance of public universities in Kenya.

Consistent with the current study , Fawcett, *et al*., (2012) affirms that the use of industry best practice and the application of value-adding technologies enables sustained delivery of high-quality, cost-effective services and capabilities that provide exceptional customer value. ICT impacts both internal process and external integration by increasing the flow of relevant information among process participants by shaping closer supplier and customer relationship.

These findings are consistent with the Resource Dependency Theory view that organizations in supply chain networks become reliant on others for input through ICT for goods and materials and management of this important relationship (Kito & New, 2015).

The findings are consistent with the findings of Peng, Quan, Zhang & Dubinsky (2016) who empirically confirmed that a firm's capability to manage both internal and external business processes fully mediate the impact of IT on supply chain performance. According to Rahimi & Kozak (2017) CRM applications help firms customize their offerings to suit the individual tastes of their customers. This customization enhances the perceived quality of products and services from a customer's viewpoint and because perceived quality is a determinant of customer satisfaction, it follows that CRM applications indirectly affect customer satisfaction. Iqbal (2014) argued that CRM applications enable firms to provide timely, accurate processing of customer orders and requests and the ongoing management of customer accounts. These results confirm the argument from previous studies that in order to succeed, integrative capabilities require important enablers such as an information sharing platforms and inter firm relationships (Tiwari, Tiwari & Samuel, 2015), supportive legislation and leadership (Wagner & Bode, 2014). Alignment of integrative capabilities to these factors increases the effect of supply chain integration on supply chain performance. However, unlike prior studies which examined the role information technology as an enabler of supply chain integration, this study focused on the mediating effect of information technology infrastructure on the relationship between supply chain integration capabilities and supply chain performance.

The study contributes to knowledge by showing empirically that information technology infrastructure a necessary condition for the effect of supply chain integration capabilities on supply chain performance.

4.11.5 Moderating effect of Government Policy on the Relationship Between Supply Chain Process Integration Capabilities and Supply Chain Performance of Public Universities in Kenya

The fifth objective sought to determine the moderating effect of government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. The resulting hypothesis was **H_{05}:** Government policy has no significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya was tested using hierarchical regression analysis. The regression results in model one indicated that the association between supply chain process integration capabilities and supply chai performance was significant ($R = .439^{a,}$ R^2=0.192, P-value<0.05). In model two ($R = .523^{a,}$ R^2=.274, P-value<0.05) and in model three ($R = .761^{a,}$ R^2=0.579, P-value<0.05). The value of the interaction term (SCPIC *GP) had a significant influence (β= .675, P<0.05) suggesting a strong moderating influence. These results support the conceptual hypothesis that the effect of supply chain process integration capabilities on supply chain performance of public universities is moderated by government policy. These finding is consistent with the Agency Theory Panda & Leepsa (2017) which assert the principle-agent relationships have to be managed well to avoid operational challenges.

These findings are congruent with observations by Ojo & Gbadabo (2014) and Hermanson, Justice, Ramamoorti, & Riley (2017) that the internal controls at an institution affect compliance with public procurement laws while weak internal controls may lead to increasing non-compliance and loss of substantial public revenue. The findings are equally consistent with Jaafar, Ramli & Aziz (2014) who revealed that perceived inefficiency of the procurement policies was found insignificantly negative impact on procurement compliance.

This finding is consistent with the finding of Kramer (2016) who established that key elements of internal controls encompass accountability, adoption of information communication technology, internal processes and ethics. The study concluded that low level of compliance with procurement regulations, lack of transparency and accountability of procurement funds lower the level of effectiveness in procurement practices in public training institutions. Sarpong et al., (2017) established that the major factors that determine the extent to which effective procurement practices are employed in public training institutions include the level of compliance with procurement regulations, minimization of procurement expenditure, transparency and accountability of procurement funds and quality of procured goods and services. Different situations may trigger the need for certain actions such as supplier selection as for instance internal controls at a university and this may affect compliance with public procurement laws (Yadav & Sharma, 2015). This is very important especially where other alternative methods of procurement other than open tender system are applied.

However, unlike prior studies which examined the effects of government policy on performance this study focused on the moderating effect of government policy on the relationship between supply chain integration process capabilities and supply chain performance of public universities in Kenya. The study contributes to knowledge by showing empirically that government policy moderates the effect of supply chain integration process capabilities on supply chain performance.

4.11.6 Joint Effect of Supply Chain Process Integration Capabilities, Information Technology Infrastructure and Government Policy on Supply Chain Performance of Public Universities in Kenya

The sixth objective of this study was to determine the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities. Arising from this objective, the following null hypothesis was formulated and tested H_{06}: The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is not significantly different from their individual effects.

The hypothesis was tested using both simple and multiple regression analysis. Simple regression was used to test for individual independent effects while multiple regression analysis was used to test for joint effect. In the regression model, supply chain performance was the dependent variable, while supply chain process integration capabilities, information technology infrastructure and government policies were predictor variables.

The joint effect was then established by regressing supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance. The test for joint effects was performed through a separate analysis to establish the combined influence of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance. The results suggest that jointly, supply chain process integration capabilities, information technology infrastructure and government policy explain higher variation of supply chain performance, than the individual effect with R^2 for individual effect model=0.342. The regression of supply chain process integration capabilities on supply chain performance is significant with $P < 0.05$ and F ratio 254.46. The co-efficient β is also significant ($\beta = 0.473$, $t = 15.952$, $P < 0.05$).

Further IT infrastructure also showed significant stimulus on supply chain performance (R^2=0.274, F=137.97, P<0.05) (R^2=0.336, F=185.546, P<0.05). The joint influence model= (R^2 =0.688, F= 34.586, P< 0.05). The joint effect was thus higher and significant compared to the individual effect of individual variables. In view of this finding, the hypothesis that the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance is not different than the individual effect of the variables on supply chain performance was rejected. The conceptual hypothesis H_6**:** The joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is significantly different was supported.

The findings of this study are consistent with Duffy, Jeyaraj, Farmer & Sethi, (2015) study who argued that business strategy aligned consistent to supply chain strategy leads to supply chain integration. The findings of this study further lend support to the view that alignment among organizational variables achieves high performance. By showing that the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance is different and greater than the individual effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance this study makes important contribution in lending empirical support to contingency perspectives on the relationship between supply chain process integration capabilities and supply chain performance.

4.12 Summary of Results of Tests of Hypotheses

Test of hypotheses began by testing the main effect of supply chain process integration capabilities on supply chain performance of public universities and the influence of information technology infrastructure and government policy on the relationship. Finally, the study tested the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya. The summary of the objectives, hypotheses, results and conclusions made on the tests of hypotheses of this study are presented in Table 4.30.

Table 4.30: Summary of the Results of the Tests of Hypotheses

Objectives	Hypotheses	Results	Conclusions
Determine the influence of supply chain process integration capabilities on supply chain performance of public universities in Kenya.	**H_{01}** Supply chain process integration capabilities have no significant influence on SC performance of public universities in Kenya. **H_1:** Supply chain process integration capabilities have significant influence on supply chain performance of public universities in Kenya.	R=.584 and the coefficient of determination (R^2) =.341 implying a relatively strong association between supply chain process integration capabilities and Supply chain performance and that a SC process integration capability is a good predictor of supply chain performance (β =.522, t=4.981, p<0.05).	Null hypothesis was rejected and therefore, conceptual hypothesis was supported.
Establish the influence of supply chain process integration capabilities on information technology infrastructure.	**H_{02}** Supply chain process integration capabilities have no significant influence on information technology infrastructure in supply chain performance of public universities in Kenya. **H_2** Supply chain process integration capabilities have a significant influence on information technology infrastructure in supply chain performance of public universities in Kenya.	Coefficient of determination R^2=.327 an influence of SC process integration capabilities on information technology infrastructure and statistically significant (β =.553, F=15.478, P=.000) at 95% confidence level.	Null hypothesis was rejected and therefore, conceptual hypothesis was supported.
Assess the influence of information technology infrastructure on supply chain performance of public universities in Kenya.	**H_{03}** Information technology infrastructure has no significant influence on supply chain performance of public universities in Kenya. **H_3** Information technology infrastructure has a significant influence on supply chain performance of public universities in Kenya.	Coefficient of determination R^2=.431 an influence of information technology infrastructure on supply chain performance and statistically significant (β=.608, F=36.406, P=.000) at 95% confidence level.	Null hypothesis was rejected and therefore, conceptual hypothesis was supported.
Establish the mediating effect of information technology infrastructure on the relationship between SCPIC and supply chain performance of public universities in Kenya.	**H_{04}** Information technology infrastructure has no significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. **H_4** Information technology infrastructure has a significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.	When information technology infrastructure is controlled R^2 =.091 which is not statistically significant (p-value=.091 which is greater than 0.05 threshold at 95% confidence level. At model 2, information technology infrastructure adds significantly to the supply chain performance as the variation increased from .091 to .730 and p-value=.000 which is significant. The results reveal that the variance explained by IT infrastructure is insignificant (F=14.193, p-value=.231).	Null hypothesis was rejected and therefore, conceptual hypothesis was supported.

Objectives	Hypotheses	Results	Conclusions
Determine the moderating effect of government policy in the relationship between SCPIC, and performance of supply chain performance of public universities in Kenya.	**H_{05}** Government policy has no significant moderating influence on the relationship between supply chain process integration and supply chain performance of public universities in Kenya. **H_5** Government policy has a significant moderating influence on the relationship between supply chain process integration and supply chain performance of public universities in Kenya.	In model one the result indicates that the association between SCPIC and supply chain performance was significant (R= .439[a,] R^2=0.192, P-value<0.05). In model two (R= .523[a,] R^2=274, P-value<0.05) and in model three (R= .761[a,] R^2=0.579, P-value<0.05). The value of the interaction term (SCPIC *GP) had a significant influence (β= .675, P<0.05) suggesting a strong moderating influence.	Null hypothesis rejected and therefore, conceptual hypothesis was supported.
Determine the joint effect of supply process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya.	**H_{06}** the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is not different from their individual effects. **H_6** the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is different from their individual effects.	R^2 for individual effect model=0.342. The regression of SCPIC on supply chain performance is significant with P < 0.05 and F ratio 254.46. The co-efficient β is also significant (β = 0.473, t = 15.952, P < 0.05) Further information technology infrastructure also showed significant stimulus on supply chain performance (R^2=0.274, F=137.97, P<0.05) (R^2=0.336, F=185.546, P<0.05). The joint influence model= (R^2 =0.688, F= 34.586, P< 0.05). The joint effect was thus significant, higher and different compared to the individual effect of individual variables of on supply chain performance of public universities in Kenya.	Null hypothesis rejected and therefore, conceptual hypothesis was supported.

CHAPTER FIVE
SUMMARY, CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to assess the influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. In this chapter, a summary of the major findings of the study are presented, conclusions, implications as well as recommendations. The chapter further discloses the proposed areas for future research.

5.2 Summary of Findings

The specific objectives of the research were: to determine the influence of supply chain process integration capabilities on SC performance of public universities in Kenya, to establish the influence of supply chain process integration capabilities on information technology infrastructure in SC performance public universities in Kenya, to assess the influence of information technology infrastructure on SC performance of public universities in Kenya, to establish the mediating effect of information technology infrastructure on the relationship between supply chain process integration and SC performance of public universities in Kenya, to determine the moderating effect of government policy in the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya and lastly to establish the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya.

The study was set to assess the relationship between supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya. The first objective of the study was to determine the influence of supply chain process integration capabilities on the supply chain performance of public universities in Kenya. The findings reveal a positive and significant relationship between the dimensions of supply chain process integration capabilities and supply chain performance, sufficient to support the conceptual hypothesis H1: Supply chain process integration capabilities have a significant influence on supply chain performance of public universities in Kenya.

The second objective of the study was to establish the influence of supply chain process integration capabilities on information technology infrastructure in public universities in Kenya. The composite index was computed for both the variables attributes and the hypothesis tested through simple linear regression analysis. The results showed a significant relationship between supply chain process integration capabilities and information technology infrastructure. These results were sufficient to support the conceptual hypothesis H2: Supply chain process integration capabilities have a significant influence on information technology infrastructure in the supply chain performance of public universities in Kenya.

The third objective of the study was to assess the influence of information technology infrastructure on the supply chain performance of public universities in Kenya. The composite index was computed for both the variables attributes and the hypothesis tested through simple linear regression analysis.

The findings showed a significant and statistical influence of information technology infrastructure on supply chain performance of public universities and these were sufficient to support the conceptual hypothesis H3: Information technology infrastructure has a significant influence on the supply chain performance of public universities in Kenya.

The fourth objective of the study sought to determine the mediating effect of information technology infrastructure on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. The regression results indicate that all the conditions for validating complete mediation were met fully. This shows that information technology mediates the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. This result was sufficient to support H4: Information technology infrastructure has a significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

The fifth objective of the study sought to determine the moderating effect of government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. Data on the three variables were subjected to hierarchical regression analysis. The results revealed that government policy has a significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. The results were sufficient to support conceptual hypothesis H5: Government policy has a significant moderating influence on the relationship between supply chain process integration and supply chain performance of public universities in Kenya.

The sixth objective of the study sought to establish the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya. The corresponding hypotheses were tested using simple and multiple regression analyses. The regression results showed that the combination of supply chain process integration capabilities, information technology infrastructure and government policy explicated superior variance on supply chain performance, than the variance explained by individual variables. Thus, the results were sufficient to support the conceptual hypothesis H_6**:** the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya is different from their individual effects.

5.3 Conclusion

The broad objective of this study was to assess the influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. The specific objectives of the study were to determine the influence of supply chain process integration capabilities on the supply chain performance of public universities in Kenya. Establish the influence of supply chain process integration capabilities on information technology infrastructure in public universities in Kenya. Assess the influence of information technology infrastructure on the supply chain performance of public universities in Kenya.

Establish the mediating effect of information technology infrastructure on the relationship between supply chain process integration and supply chain performance of public universities in Kenya. Determine the moderating effect of government policy on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya. To establish the joint effect of supply chain process integration capabilities, information technology infrastructure and government policy on supply chain performance of public universities in Kenya.

The findings of the study lead to the following conclusions. There is a linkage between supply chain process integration capabilities and supply chain performance of public universities in Kenya and supply chain process integration capabilities are positively related to the supply chain performance of the public universities. The findings confirm that supply chain process integration capabilities are central to enhancing supply chain performance. Hence higher levels of integration would result in higher levels of supply chain performance.

The results also revealed that information technology infrastructure mediates the relationship between supply chain process integration capabilities and supply chain performance. In other words, supply chain process integration capabilities affect information technology infrastructure which in turn affects supply chain performance. Consequently, supply chain process integration capabilities are critical in enhancing information technology infrastructure and successful supply chain performance. The results further reveal that government policy moderates the relationship between supply chain process integration capabilities and supply chain performance.

Aligning supply chain process integration capabilities with government policy enhances the effect of supply chain process integration capabilities on supply chain performance.

Finally, the results show that the combined effect of supply chain process integration capabilities, information technology infrastructure and government policy is greater than the individual effect of supply chain process integration capabilities alone. This confirms that integrating supply chain process integration capabilities, information technology infrastructure and government policy enables greater effects on supply chain performance than that of the individual effects of the independent variables on supply chain performance of public universities in Kenya. This implies that organizations including public universities that aspire to achieve superior supply chain performance have to deliberately integrate appropriate supply chain process integration capabilities, information technology infrastructure and government policy to build an agile end to end systems to attain and sustain competitive advantages in the markets.

5.4 Implications of the Research Findings

This study was grounded in the Resource-Based View, Resource Dependency Theory, Agency Theory and Collaborative Network Theory to assess the effect of supply chain process integration capabilities on supply chain performance of public universities. Establish whether information technology infrastructure mediates the relationship between supply chain process integration capabilities and supply chain performance. Determine the moderating effect of government policy on the relationship between supply chain process integration capabilities and supply chain performance.

To establish whether the joint effect of supply chain process integration capabilities, Information technology infrastructure and government policy on supply chain performance of public universities in Kenya is greater than individual variable effects on supply chain performance of public universities in Kenya. The findings of the study conducted in 31 public universities in Kenya have numerous implications.

The study reveals that information technology infrastructure mediates the effect of SCPIC on supply chain performance. This finding supports the arguments of the Collaborative Network Theory approach. The theory accentuates that firms need to integrate, reconfigure, upgrade and recreate their resources and capabilities in response to the turbulent environment to attain and sustain competitive advantage. Further, Competition in supply chain management is between supply chain structures away from the organizational level. There is, therefore, a need for an appropriate organization structure that spans across the firms' boundaries to the whole supply chain. This calls for finding the best structure which is contingent on the situation thus the success of supply chain process integration is dependent on whether it can offer a strategy-structure fit.

The study also revealed that SCPIC has a positive linkage on supply chain performance in public universities in Kenya. These findings are supported by the Resource-Based View (RBV) that assumes that a firm's competitive advantage and performance is enhanced when it has resources that are valuable, rare, inimitable and non-substitutable. RBV scholars argue that the development of capabilities involves effective management and utilization of organizational processes because capabilities are embedded in organizational routines and can be achieved through cooperation and coordination.

The RBV perspective indicates that if a firm is more proficient with its process management than its rivals through process integration this denotes a distinctive capability which can lead to superior productivity. Supply chain process integration enables firms to realign processes and resources more effectively which leads to the development of supply chain capabilities of complex bundles of skills and collective learning exercised through organizational processes that ensure superior coordination of functional activities.

The study adopted an integrated model that examined the joint effect of the study variables on supply chain performance. The finding that the joint effect of SCPIC, information technology infrastructure, and government policy was greater than the individual effects of SCPIC on supply chain performance also confirms the arguments of the Resource Dependency Theory and Collaborative Network Theory that integrating contingency variables, SCPIC, information technology infrastructure and government policy achieves higher outcomes.

The study implies that policymakers and implementers have to formulate superior supply chain process integration capabilities, information technology infrastructure and government policy to achieve high levels of supply chain performance in public universities. This can help in building a robust and agile end to end supply chain system, policies, procedures, guidelines and practices for the attainment of competitive advantages in operations.

This study indicates that SCPI affects supply chain performance through increased information technology infrastructure (external and internal integration). The public universities significantly contribute to the development of human capital and research for economic development, these calls for effective and efficient management of resources and service delivery. Due to the intangible nature of services in most of the universities activities require high levels of integration. Measures have to be instituted to provide superior information technology infrastructure capabilities to enhance the supply chain performance of public universities for operational competitiveness and sustainability.

The major managerial implication of this study is that public universities should intentionally develop different generic supply chain capabilities to achieve different types of organizational performance. For example, public universities must first establish internal integration before they can achieve external integration. If public universities have a weak internal integration, such as poor internal information integration, less communication among functions, no teamwork or conflicts within the university, it will be difficult for them to share or exchange information and to work together with their customers and/or their suppliers. Without integrative information management, universities will have little chance to share their production plans with customers or suppliers. Public universities must pay attention to customer integration, including customer relationship management, strategic alliance with customers, information sharing and communication with customers, and process coordination with customers because of it directly influences customer operational performance, which leads to better supply chain performance. Thus, customer integration is more effective than supplier integration in improving performance.

Public universities with higher levels of effective customer integration are more likely to be financially rewarded for their efforts. Universities should develop supplier integration, including supplier relationship management, strategic alliance with suppliers, information sharing with suppliers, working together with suppliers, joint design with suppliers, which is helpful for supplier operational performance and leads to better supply chain performance. If there is no resource constraint, universities should develop all three types of supply chain process integration capabilities, because it is only when all three are well developed that public universities will achieve the highest supply chain performance.

This study provides empirical evidence to support conceptual and prescriptive statements in the literature regarding the impact of supply chain process integration capabilities. These higher-order boundary-spanning capabilities require the sharing of strategic, tactical and operational information and global optimization of physical flows across supply chains.

As competition has shifted from companies to supply chains, universities should carefully develop internal and external integrative capabilities to meet the requirements of environments, customers, and stakeholders. Managers should adopt a holistic supply chain integration view to manage their supply chains to achieve and sustain superior performance.

5.5 Limitations of the Study

This study has contributed to providing an understanding of the effects of information technology infrastructure and government policy on the relationship between SCPIC and supply chain performance. However, the study has some limitations. The study adopted a cross-sectional survey research design in which data was collected once at a single point in time. The study used a cross-sectional survey to collect data from public universities. A single cross-section survey is not able to capture the long-term effects of changes. Normally, changes emerge over time. Therefore, longitudinal research can solve this limitation by separating data collection into several phases to investigate the phenomenal changes. The one-time survey was adopted due to the constraints of cost and time. Although cross-sectional studies help get insights into aspects of variables, perceptions vary over time and thus cross-sectional studies have limitations in determining causal relationships.

The study used quantitative analysis. Qualitative data from respondents was not used because the questionnaire used had closed-ended, this could have had a bearing on the narrative. The Likert-scale type survey can also be considered a limitation of this research because the data collection following the measurement items that show in the questionnaires only; it meant that the findings related to only the questions or the researcher could measure only all variables in the questionnaire. The survey methodology that was used gained data related to items of a latent construct. Therefore, any additional information that relates to another phenomenon under investigation cannot be highlighted. This study was conducted in public universities in Kenya.

Universities fall under the service sector and may differ with private universities and to a large extent differ with manufacturing firms that are more technological and scale intensive while service organizations are more skill-intensive. Thus, manufacturing firms are likely to be different from service firms in supply chain management practices. Hence the findings of this study may not be generalizable to manufacturing organizations.

Further, countries differ in terms of contextual factors such as economic conditions and technological advancements. These contextual differences may affect levels of capabilities and performance. Hence because of these contextual differences across countries, the findings of this study conducted in Kenya, may not be generalizable to other countries with different contextual conditions. This study used two respondents in each university to collect data mainly heads of procurement and ICT. Single respondent studies are prone to single respondent bias which may affect the validity of the study

5.6 Recommendations for Further Research

This study recommends that further research is necessary to address some of the limitations of this study and extend this stream of research. First, the respondents of this study were heads of departments where two respondents were used in each organization to collect data. To minimize the effect of single respondent bias, future research can use multiple respondents including top, lower and middle managers.

Secondly, this study adopted a cross-sectional survey. Such studies have limitations on providing explanations on the linkages between variables. A longitudinal study could increase understanding of the influence of contingency factors on the relationship between SCPIC and supply chain performance.

Thus, future research should consider adopting a longitudinal research design in data collection to enhance understanding of the relationship between the variables.

In the present study, SCPIC was conceptualized using the widely used conceptualization in terms of information flow, physical flow, and financial flow integration. Future research should broaden the conceptualization of SCPIC to include other aspects such as knowledge flow. Future studies may also consider the inclusion of other organizational variables that may influence the relationship between SCPIC and supply chain performance either as moderating or mediating variables other than information technology infrastructure and government policy as used in this study.

The study should be replicated in other service sectors to include private firms and manufacturing and even in other countries. Such replication could further help in determining whether the results of this study can be generalized to other sectors or countries with different contextual conditions. This can help in enhancing understanding of the relationship between SCPIC and supply chain performance in different contexts.

5.7 Contributions of the Study

This study adds more information to the body of knowledge. The study found that supply chain process integration capabilities influence the supply chain performance of public universities in Kenya. The study also found that information technology has a positive and significant mediating effect on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

Besides, the study revealed that government policy has a positive and significant moderating influence on the relationship between supply chain process integration capabilities and supply chain performance of public universities in Kenya.

5.8 Summary of the Chapter

Chapter Five has presented the summary, conclusion, and implications of the study. The chapter began with a summary of the objectives of the study. The chapter explains the conclusions made on the hypotheses in the context of the findings drawn after analysis. The results indicate that the null hypotheses were rejected and the conceptual hypotheses supported. The broader implications of the findings for policy, practice, and theory, limitations of the study, recommendations, and contributions of the study are also provided.

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APPENDICES

APPENDIX I: LETTER OF INTRODUCTION

Judith Nelima Wasike Milimo
P.O. Box 52428 – 00200
NAIROBI.

Dear Respondent,

My name is **JUDITH NELIMA WASIKE MILIMO.** I am a Ph.D. candidate from the Technical University of Kenya, Department of Business Administration and Management. This survey research is a partial fulfillment of requirements for the award of Doctor of Philosophy Degree in Business Administration (Procurement and Supply Chain Management). The purpose of the study is to examine the ***Influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities, and supply chain Performance of public universities in Kenya.*** The results from this study will be published in respected journals dedicated to Logistics and Supply Chain Management, and operations management, which are educational and useful for the procurement and supply chain community.

The questionnaire forms an integral part of the study. I am therefore, kindly requesting you to assist in facilitating the completion of the questionnaire. The instructions for completing the questionnaire can be found on the questionnaire itself. The survey will take about 30 minutes to complete.

Please be assured that the information and data you provide will remain secured and will only be used for scientific research purposes treated in total confidentiality. A copy of the research results will be provided upon request. If you have any enquiries, please feel free to contact me using my contact details below.

Yours Faithfully,

Judith Nelima Wasike Milimo
PhD. Candidate
Technical University of Kenya
Cell phone: 0733862864/0714050235
Email: wasikejudith@yahoo.com

APPENDIX II: STUDY QUESTIONNAIRE

I am a Doctor of Philosophy (PhD) Candidate in the Department of Business Administration and Management, Technical University of Kenya Nairobi. As part of the requirements for the award of the degree, I am expected to undertake a research study on: ***Influence of information technology infrastructure and government policy on the relationship between supply chain process integration capabilities, and supply chain Performance of public universities in Kenya.*** I am therefore, seeking your assistance to fill the questionnaire attached. Kindly answer all the questions. The research results will be used for academic purposes only and will be treated with utmost confidentiality.

SECTION A: PERSONAL INFORMATION

1. Gender Male ☐ Female ☐
2. Age
   - Up to 40 years ☐
   - 41 to 50 ☐
   - 51 - 60 ☐
   - 61-70 ☐
   - 71 and above ☐
3. Highest level of education
   - Doctorate ☐
   - Master ☐
   - Bachelors ☐
   - Higher Diploma ☐
4. Designation/ Title
   - Senior manager ☐
   - Middle level manager ☐
5. Number of years worked in the department ☐
   - Up to 10 years ☐
   - 11-20 ☐
   - 21- 30 ☐
   - 31- 40 ☐
   - Above 41 years ☐

SECTION B: UNIVERSITY INFORMATION

1. Name of university……
2. Name of Department
   - Procurement ☐
   - ICT ☐
3. Number of employees in the department ☐
4. Years of operation as a university ☐
5. Indicate what type of Information Technology (IT) your university uses for external collaboration
   - 5.1. Sales/demand forecasts ☐
   - 5.2. Customer relationship management systems ☐
   - 5.3. Supplier relationships management systems ☐
   - 5.4. Vendor management inventory system ☐
   - 5.5 Collaborative portals ☐
6. Indicate what type of management systems your university uses to manage supply chain process.
   - 6.1. Material resource planning ☐
   - 6.2. Enterprise resource planning ☐
   - 6.3. Decision support systems ☐
   - 6.4. Transport management systems ☐
   - 6.5. Electronic invoice and fund transfer systems ☐
   - 6.6. Real time and tracking system ☐
7. Indicate the type (s) of e-procurement categories your university uses.
   - 7.1 E-MRO ☐
   - 7.2. E-Tendering ☐
   - 7.3. E-Procurement ☐
   - 7.4. ERP ☐
   - 7.5. E-Informing ☐
   - 7.6 E-Application/admission ☐
   - 7.7 E-quotation ☐

	PART C: Supply chain process integration. Please tick the level of agreement on each of the items below					
	On a scale of 5; where 1: Strongly disagree, 2: Disagree, 3: Neither Agree or Disagree 4: Agree, 5: Strongly Agree					
8.0	**Information flow**	1	2	3	4	5
8.1	Our university shares its business unit's propriety information with its supply chain partners					
8.2	Our university shares information with its supply chain partners in advance of changing needs					
8.3	Our university and its partners exchange information that helps establishment of business planning					
8.4	Information exchange between our university and its supply chain partners is timely, adequate, complete, reliable					
8.5	Our supply chain partners are actively involved in standardizing Supply chain practices					
9.0	**Physical flow**					
9.1	Movement of goods from source to customer influence supply chain integration					
9.2	Integration of systems with supplier's influence supply chain integration					
9.3	My university has an inventory management system integrated with our suppliers					
9.4	My university has supplier relationship management systems					
9.5	My university has customer relationship management systems					
9.6	My university has decision support management systems					
9.7	Supply chain process integration influences Information technology (IT) infrastructure					
10.0	**Financial flow**					
10.1	Integration facilitates the of flow of funds in my university					
10.2	Through SC integration my university has been adopted e- invoicing					
10.3	Through SC integration my university has been adopted e- payments					
10.4	Through SC integration my university has adopted Internal e-transfers					

PART D: **INFORMATION TECHNOLOGY INFRASTRUCTURE**

The following statements describe the extent to which the ICT department collaborates with other business functions by using information technology (IT). Please TICK the appropriate number to indicate the extent to which you agree or disagree with each statement as applicable to your unit.

On a scale of 5; where 1: Strongly Disagree, 2: Disagree, 3: Neither Agree or Disagree 4: Agree, 5: Strongly Agree

11.0	**Internal Information Technology Infrastructure**	1	2	3	4	5

11.1	Through ICT my university shares a sense of fair play with its customers					
11.2	Through ICT my university frequently interacts with customers to set its reliability responsiveness and other standards					
11.3	Through ICT my university frequently follows our customers for quality service feedback					
11.4	Through ICT my university frequently determines future customer expectations					
11.5	Through ICT my university facilitates customers' ability to seek assistance from it					
11.6	Through ICT my university periodically evaluates the formal and informal complaints of its customers					
11.7	Through ICT my university periodically evaluates the importance of its relationship with its Customers					
11.8	Through ICT my university contributes to the efficiency and effectiveness of our business processes					
11.9	Through ICT my university enables university to break time barriers					
11.10	Through ICT my university enables university to break cost barriers					
11.11	Through ICT my university enables value addition to product/services					
11.12	Through ICT my university provide rich data about customers and Competitor					
12.0	**External Information Technology infrastructure**					
12.1	Through ICT my university can optimize the supply chain processes with external firms					
12.2	Through ICT my university can effectively transact with our external firms through standardized information format e.g. Excel, PDF, HTML, EDI)					
12.3	Through ICT my university can effectively access our Information Technology network properly and securely to communicate with external firms (e.g. internet/LAN access anytime anywhere)					
12.4	Through ICT my university can effectively transact with external firms by using our advanced hardware (e.g. Computer, field devices, sensors, meters, servers etc.)					
12.5	Through ICT my university can effectively transact with external firms by using our advanced software and applications (e.g. Logistics portals, email systems, etc.)					
12.6	Through ICT my university can easily build and alter our information linkages to our existing supply chain partners (e.g. customers, suppliers and third-party logistics providers in response to changes in the business environment)					
12.7	Through ICT we can easily build and alter our information linkages to new supply chain partners					

12.8	Through ICT my university strives to establish long-term relationship with suppliers					
12.9	Through ICT my university includes key suppliers in its planning and goal setting					
12.10	Through ICT my university actively involves its key suppliers in new product development					
PART E: Government Policy. **Please tick the level of agreement on each of the items below**						
On a scale of 5; where 1: Strongly Disagree, 2: Disagree, 3: Neither Agree or Disagree 4: Agree, 5: Strongly Agree						
13.0	**Procurement Law**	1	2	3	4	5
13.1	In my university public procurement policy enables public private partnership procurement					
13.2	Public Procurement allows my university to do joint procurements with other universities					
13.4	In my university public procurement enables collaborations with other universities					
13.5	In my university we comply with Public Procurement Act to the later					
14.0	**Procurement Procedures**					
14.1	In my university public procurement procedures in terms of acquiring goods, service and works are satisfactory					
14.2	In my university consider public procurement procedures in terms of asset disposal are satisfactory					
14.3	In my university public procurement enables collaborations with other universities					
14.4	In my university open tendering is the most common method used for procuring					
	PART F: Supply Chain Performance of Public university. Please tick the levels of agreement on each of the items below					
	On a scale of 5; where 1: Strongly Disagree, 2: Disagree, 3: Neither Agree or Disagree 4: Agree, 5: Strongly Agree					
15.0	**Internal Dimension-Process Flexibility**	1	2	3	4	5
15.1	My university has the ability to respond to and accommodate demand variations					
15.2	My university has the ability to respond to and accommodate the periods of poor supplier performance					
15.3	My university has the ability to respond and accommodate periods of poor delivery performance					
15.4	My university has the ability to respond and accommodate new products, new markets or new competition					
16.0	**Cost leadership**					
16.1	My university optimizes on total costs associated with delivery, return on investments					
16.2	Produce materials/components/products at low cost					
16.3	Our organizations strategy on cost leadership has reduced production our cost					
16.4	Our organizations strategy on cost leadership has reduced our inventory costs					
16.5	Our organizations integration strategy on cost leadership has reduced our unit cost					
16.6	Our organizations strategy on cost leadership has increased our labor productivity					

17.0	**Delivery reliability**					
17.1	Supply chain integration allows my university to facilitate time breaks					
17.2	Supply chain integration allows my university to facilitate real-time deliveries					
17.3	Provide materials/components/products that are highly reliable					
17.4	The university supply chain integration strategy has enabled faster deliveries to our customers					
17.5	The university supply chain integration strategy has enabled on-time deliveries					
17.6	The university supply chain integration strategy enabled reliable deliveries					
17.7	The university supply chain integration strategy has led to a decrease in the lead time					
18.0	**Customer service dimension**					
18.1	There is improvement in terms of speed of operations in my university due to supply chain process integration					
18.2	My university's level of service provided to customers has improved					
18.3	There is improvement in terms of quality of service/product in my university due to supply chain process integration					
18.4	There is improvement in the quality of service/products to our customers due to Supply chain process integration					

Thank you

APPENDIX III: LIST OF PUBLIC UNIVERSITIES IN KENYA

1. The University of Nairobi, Nairobi County
2. Technical University of Kenya, Nairobi County
3. Dedan Kimathi University of Technology, Nyeri County
4. Multimedia University of Kenya, Nairobi County
5. University of Eldoret, Uasin Gishu County
6. Meru University of Science and Technology, Meru County
7. South Eastern Kenya University, Kitui County
8. Karatina University, Karatina
9. Murang'a University of Technology, Muranga County
10. Kenyatta University, Kiambu County
11. Egerton University, Nakuru County
12. Moi University, Uashi Gishu County
13. Maseno University, Kisumu County
14. Jomo Kenyatta University of Agriculture and Technology, Kiambu County
15. Masinde Muliro University of Science and Technology, Kakamega County
16. Laikipia University, Laikipia County
17. Technical University of Mombasa, Mombasa County
18. Jaramogi Oginga Odinga University of Science and Technology, Bondo
19. The Co - Operative University of Kenya, Nairobi County
20. Rongo University, Migori County
21. Kisii University, Kisii County
22. Kibabii University, Bungoma County
23. Chuka University, Tharaka Nithi County
24. Kirinyaga University, Kirinyaga County
25. Machakos University, Machakos County
26. Pwani University Kilifi County
27. Taita Taveta University, Taita taveta County
28. University of Embu, Embu County
29. Garissa University College, Garissa County
30. Maasai Mara University, Narok County
31. University of Kabianga, Kericho County

Source: Commission of University Education, (2017)

APPENDIX IV: LETTER OF INTRODUCTION FROM THE UNIVERSITY

Technical University of Kenya, Haile Selassie Avenue, P. O. Box 52428- 00200 NAIROBI
Tel +254 (020) 343672, 2249974, 2251300, 251300, 251822, 2250522

SCHOOL OF GRADUATE AND ADVANCED STUDIES

July 21, 2017 REF: PHD/ABBY/06478P/2015.

TO WHOM IT MAY CONCERN

This is to inform you that the bearer, Ms Judith Nelima Wasike, is a registered PhD student in the Department of Business Administration and Management, School of Business and Management Studies, Technical University of Kenya. She is currently proceeding for field work which will involve data collection using approved surveys and research methods.

Her research topic is: Supply Chain Integration Process Capabilities, Information Technology Infrastructure and Performance of Public Universities in Kenya.

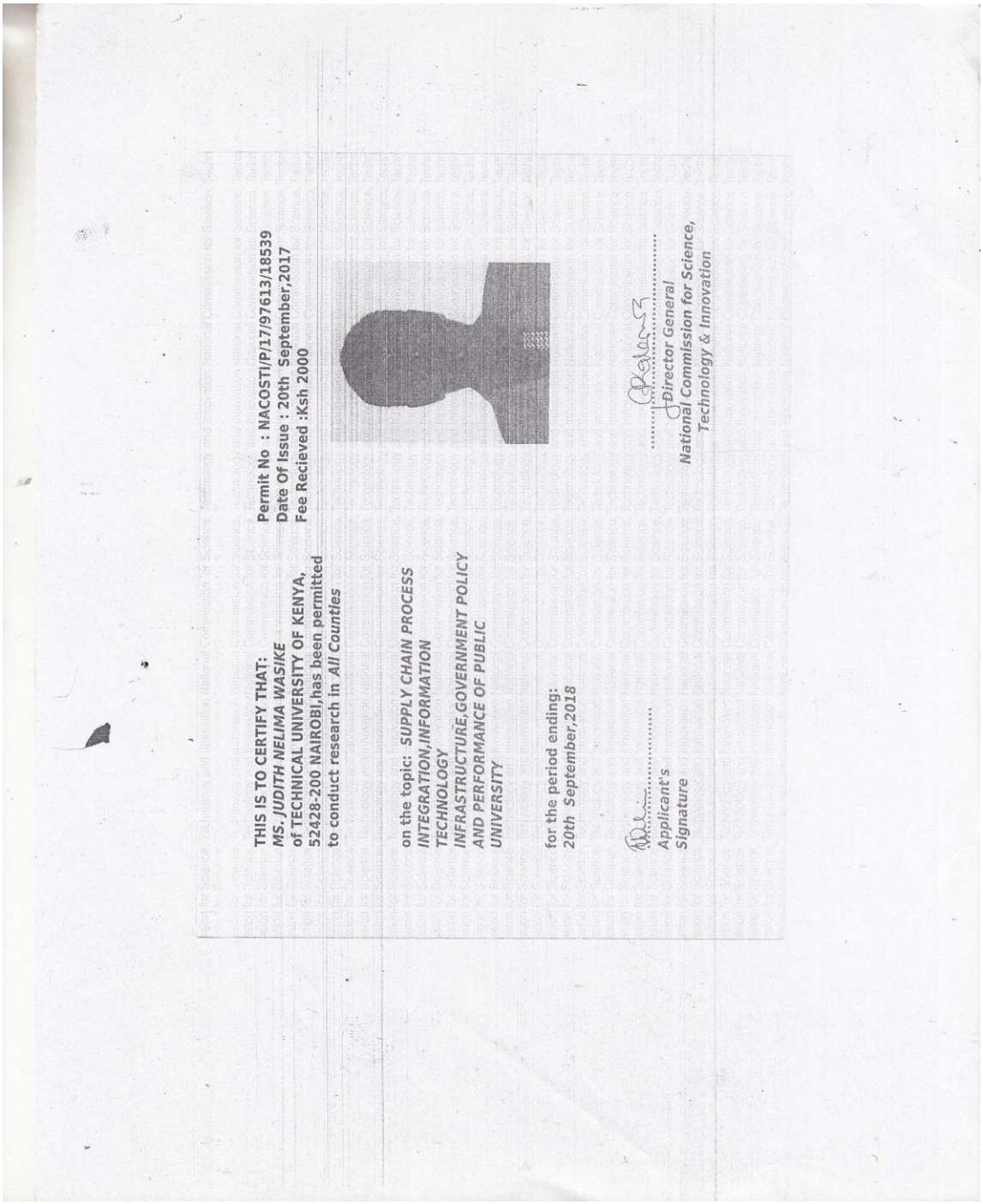
Any assistance accorded her will be highly appreciated.

SCHOOL OF GRADUATE & ADVANCED STUDIES
DIRECTOR
21 JUL 2017
THE TECHNICAL UNIVERSITY OF KENYA

Prof. J.O. Lalah

Director- School of Graduate and Advanced Studies.

APPENDIX V: NATIONAL COMMISSION FOR SCIENCE AND TECHNOLOGY AND PERMIT



THIS IS TO CERTIFY THAT:
MS. JUDITH NELIMA WASIKE
of TECHNICAL UNIVERSITY OF KENYA,
52428-200 NAIROBI,has been permitted
to conduct research in *All Counties*

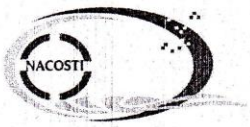
Permit No : NACOSTI/P/17/97613/18539
Date Of Issue : 20th September,2017
Fee Recieved :Ksh 2000

on the topic: *SUPPLY CHAIN PROCESS INTEGRATION,INFORMATION TECHNOLOGY INFRASTRUCTURE,GOVERNMENT POLICY AND PERFORMANCE OF PUBLIC UNIVERSITY*

for the period ending:
20th September,2018

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: 020 400 7000,
0713 788787,0735404245
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/97613/18539** **Date:20th September,2017**

Judith Nelima Wasike
The Technical University of Kenya
P.O Box 52428-00200
Nairobi.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Supply chain process integration, information technology infrastructure, government policy and performance of public university"*** I am pleased to inform you that you have been authorized to undertake research in **all Counties** for the period ending **20th September, 2018.**

You are advised to report to **the County Commissioners and the County Directors of Education, all Counties** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioners
All Counties.