ROLE OF INFORMATION SYSTEMS COMPETENCE IN SUPPLY CHAIN AGILITY IN SERVICE INDUSTRY

CASE OF TECHNICAL UNIVERSITY OF KENYA

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Abstract

The purpose of this study was to examine the relationship between information systems and supply chain agility in service industry. Using a sample of 96 (N= 96) top, middle and lower level staff of the Technical University of Kenya and a case study design, the research is conducted through interviews and survey by use of interview guides and questionnaires to collect data from the respondents. Interviews were carried out with top management in the supply chain and surveys from both the middle and lower level managers across Information systems and supply chain management –related departments. The data collected was analysed descriptively and inferentially using regression and confirmatory factors analyses through the Statistical Package for Social Sciences. The study was augmented by investigating the role of IS competence to achieve supply chain agility. A gap noted and filled by the study is that as to date most of the published literature in this stream of research has mainly focused on manufacturing industry leaving out the service industry. This research was an attempt to examine and analyze the use and value of IT enabled capabilities to promote supply chain agility in service industry. Agility capabilities are the strengths the firm needs in order to respond to the environment that are enabled through the agility providers of the organizations, people, technology and innovation. The study findings concurred with the views of most scholars that Information Systems (IS) have rapidly reshaped business processes and supply chain agility as an operational strategy, has been especially affected. From the F statistic test value of 26.551 and a small significance value of 0.000 that is P = 0.000 > α = 0.05, indicates that there is a regression relationship between the dependent variable (supply chain agility) and the predictor variables. For instance the study supports the importance of information systems service competence based on low response time to IS problems to enhance speed and efficiency and management skills based on network management enhancing collaborative abilities, data centre management to enhance virtual integration and contributing to quick   service delivery in the context of supply chain agility. The R Square value of 0.956 shows that the variables account for 95.6% of the change in supply chain agility. From findings it can be concluded that IT Service Competence affects supply chain agility more in the institution followed by IT Services Management Skills as measured by the various items under each predictor.

Keywords: *Information Systems Competence, Supply Chain Agility, Information Systems, Service Industry*

1.0 Introduction

In today's volatile markets, firms are faced with competition, rapidly changing customer demands and an accelerating pace of technological change (Ganguly *et. al.,* 2009). Under these conditions, the ability to sense market changes and respond quickly to these changes is imperative to firm's success (Overby *et al.*, 2006). As a result of these business environments, the concept of agility has evolved as an opportunity for firms to address uncertain and turbulent markets hence firms must be able to change business processes rapidly and efficiently in line with the changing business conditions and customer needs (Aitken, *et al.,* 2002; Christopher, 2000). Thus, agility, a combination of speed and flexibility, is becoming a vital tool for innovation and competitive performance in contemporary business environments. Agility is a complex concept and has been analyzed across economics, strategic management, and operations management and information technology and information systems disciplines. The concept of agility builds from the literature on flexibility in economics (Mathiyakalan, Ashrafi, Zhang, & Waage, 2005), and was further developed in the context of agile manufacturing. According to Yusuf and others, the concept of agility was first coined in 1991 by a group of senior executives and researchers at Iaccoca Institute to describe the practices observed and considered as important aspects of manufacturing (Burgess, 2003).

The concept of supply chain agility is only 20 years old and is called a 21st century paradigm. Lots of discussions about what agility is indeed and how can enterprises become agile took place during last two decades (Sanchez & Nagi, 2001). There are not so much scientific works published about the distinguishing factors, requirements, characteristics or evaluation of agility, especially on the level of supply chain. The supply chain agility concept as well as commonly accepted framework for agile supply chain building in a company is the field for scientific research. Supply chain agility is regarded as an operational strategy, concerning customer responsiveness and flexibility in the supply chain (Prates *et al*., 2001). It is the organizational ability to thrive by sensing and responding to environmental changes and has become critically important nowadays when the business environment is getting highly competitive and turbulent and regarded as a key business factor and a potential enabler to organization's competitiveness (Mathiassen & Pries-Heje, 2006). However, agility can be hampered by fragmented employment of information systems (IS) (Broadbent *et al.,* 1999). Studies have shown that the development of IS has rapidly reshaped business processes and supply chain agility has been especially affected (Christopher, 2004). Supply chain agility is a strategy that concentrates on improving flexibility and velocity. Organizations have supply chains and the chains depend on their size and product manufactured.

Although the history of information systems (IS) as a subject of study only spans six decades, it is among disciplines that have done much towards advancing development of the human race (Jorgenson & Vu, 2009). This is attested to by the roles played by the Internet, the Local Area Networks within enterprises, and the Wide Area Networks that connect multinational corporations throughout the globe from as early as the mid 1960s. While the business schools began to develop Management Information System (MIS) programs to meet the perceived growing needs of IS managers, the 1970s upper level management recognized the importance of IS to both business operations and business management and the flexibility it was able to bring to the entire organization (Amadi, 2013).

Telex became the standard for information transfer; while the mainframe computer became the standard for database implementation (Lyytinen & Newman, 2008; Laudon & Laudon, 1987b). By the mid-1980s most manufacturing companies had embraced IS for much of their

operations such as forecasting sales, taking orders, and managing distribution of their products. By the mid-1990s, it was evident that a corporation could not effectively and efficiently do business without a solid functioning IS setup, both inside its own walls as well as connecting it with its supply-chain stakeholders such as vendors and distributors (Amadi, 2013). Although IS has evolved over the past sixty years to become the backbone of business and industry that it is today, the simple application rules created in the 1960s and 1970s still remain relevant in applications where data or information is transferred whatever the business model, no matter the complexity (Laudon & Traver, 2011; Haag & Cummings, 2012).

Businesses rely on information systems professionals to address pertinent issues of: What information does the enterprise need? How is that information generated? Is the information delivered to the people who need it on a timely manner? Is the information presented to the people who need it in ways that permit them to use it readily? Is the organization structured in a way that makes it possible for it to use technology effectively? Are the business processes of the organization well designed? Do the business processes use the opportunities created by information technology fully? Does the organization use the communication and collaboration capabilities of information technologies appropriately? Is the organization capable of adapting quickly enough to changing external circumstances? Information systems education in Kenyan necessary to develop specific and dedicated skills for the analysis and design purpose, which are Systems Analyst and Designer skills within the IS discipline (Amadi, 2013; Harris, 2009). Some scholars have argued supply chain agility is highly dependent on the industry be it service industry or manufacturing industry. This study narrows down to the service industry with special regard to the education sector.

1.1 Service Industry in Kenya

While in manufacturing settings operational agility is usually restrained by physical constraints such as locations, resource availability and delivery time, the service industry offerings and delivery involve processes enhanced by support amenities, facilitating information and implicit services such as psychological benefits (Roth, Menor & Mason, 2001).. Moreover, the direct interaction with customers in the service setting makes it easier to collect market intelligence, the customers' demands are more complex and likely to change due to the dynamics of direct interaction with individual customers (Roth, Menor, 2003).

Due to the rapidity of competition-driven, market dynamics and customer preferences, the breath and pattern of responses required in the service settings are much broader, more frequent and sometimes more unpredictable (Beidleman & Ray 2003; Menor *et al* 2001). Little has been done to understand operational level agility in service industry such as transport, financial services, communication and education.

Countries that do well in services tend to have much more income than Kenya does, but Kenya is managing to hold in services. This is why according to the International Monetary Fund latest regional economic outlook for Sub-Saharan Africa, Kenya's ability to move up the value-added chain with its service sector, which has been the largest contributor to GDP growth and foreign exchange revenue since 2007, is significant considering its low-income status. Kenya has a number of firms exporting high value off-shore services such as product development, research and development business ventures, and insurance, accounting and BPO services (IMF, 2012). Kenya needs to maximize on this by having more small and medium enterprises adopt simple technologies in their daily business activities (KBS,

2012). According to the Kenya National Bureau of Statistics Second Quarter 2012 GDP release, services account surplus increased by 11.6 percent mainly due to increased foreign exchange receipts from tourism, transportation, communication, financial services and education.

Education Sector in Kenya
The education sector has undergone accelerated reforms that include launch and implementation of Free Primary Education (FPE), adoption of sector wide approach to planning and financing of education and training, and Free Day Secondary Education (FDSE). Implementation of these reforms requires heavy investment in construction of educational infrastructure, modern machines and technical training needs. The public and private tertiary sector has undergone dramatic growth, with conversion of some polytechnics into universities, opening of new university colleges, and of branches of existing universities. Female enrolment in public universities is 38% which is still quite low dominated by the fee-paying parallel students in public universities thus profitability on one side and quality control issues on the other hand. In response to the Government's desire to expand universities, the Kenyan education sector has become strong and dynamic, responding to a huge, widespread demand for education. The largest part of public spending within this sector comes from Government's domestic resources and development partners. In 2009/2010, Kenya spent over 6% of her GDP, 20% of public expenditures and 27% of domestic revenue on the two education ministries; Ministry of Education (MoE) and Ministry of High Education, Science and Technology (MoHEST).

1.2   Problem statement

With technological advances such as in computing, IS ought to have taken its rightful role in enhancing supply chain agility in various organizations, the business marketplace has become very agile with customers demanding lower prices, faster delivery and better quality products and services (Amadi, 2013; Meltzer *et al.,* 2001). Despite this, many supply chains coordination are still hampered by the difficulties of making information flow smoothly among disparate internal supply chain systems for purchasing, materials management, manufacturing and distribution and with external supply chain partners because the systems of suppliers, distributors, or logistics providers are based on incompatible technology platforms and standards (Meltzer *et al.,* 2001). Many other organizations have not yet realized the importance of adopting information systems in their supply chain structures, and, this may be due to a lack of awareness of the technologies and their benefits, and of the kind of support that information systems and technologies can provide (Christopher, 2004).

As a result, there is no clear understanding of the demand patterns, service level requirements, cost elements, communication, being major and other related factors all revolving around information systems (Giovanni & Mario, 2003). Agile strategies are recognized to play a major role for survival in markets more turbulent and volatile every year (Meltzer *et al.,* 2001). These help companies to provide the right product at the right time and price to customers. In an effort to achieve this, many companies have decentralized their value adding activities by out-sourcing and developing virtual enterprise (VE) in the supply chain. Information systems are no longer avoidable but imperative and therefore, there is need to adopt new technological advancements to coordinate all activities involved (Meltzer *et al.,* 2001). For instance collaborations with different partners, such as suppliers, customers, competitors, universities, consultants and formulation of supply chains are some of the measures to respond to the environment pressures (Laudon *et al.,* 2008). This study therefore sought to analyze the role of

information systems on supply chain agility in the service industry in Kenya.

1.2.3. Research objectives

The research consisted of the general objectives as well as specific objectives

1.2.4. General objectives

To determine the role of Information systems competence on supply chain agility: case of The Technical University of Kenya

1.2.5. Specific objectives

(i) To determine the role of Information systems service management skills on supply chain agility.
(ii) To investigate the role of Information systems service competence on supply chain agility.

1.3   Research questions

(i) Does Information system service management skills have any role on supply chain agility?
(ii) What is the role of Information systems service competence, on supply chain agility?

1.2. Literature Review

1.2.1 Theoretical reviews

A theory includes a set of basic assumption and axioms as the foundation and the body of the theory is composed of logically interrelated, empirically, verifiable prepositions (Camp, 2001). This study will be based on the following theories: resource-based view, knowledge management theory, organizational culture dynamic capabilities theory and concepts of supply chain management, supply chain agility, information systems. The conceptual analytic research is a theoretical research and thus like Järvinen (2012), the view of theory by Gregory (2002) is adopted. Gregory (2002)suggested that "theory answers a human need to make sense of the world and to accumulate a body of knowledge that aids in

understanding, explaining and predicting the things we see around us, as well as providing a basis for action in the real world". Webster and Watson (2002) argued for need for a proper literature review to any academic research.

Moreover, they noted that literature review has different roles, for example, enables theory development and reveals areas where research is needed. In this research, both these roles of literature review have been incorporated because the research domain is relatively new.

1.2.2 Resource Based View

Resource-based view of the firm in particular, provides the theoretical foundation for research in information systems management that has examined the links between IT capabilities and firm performance. The resource-based view (RBV) argues that firms possess resource, a subset of which enables them to achieve competitive advantage, and a subset of those that lead to superior long-term performance. Resources that are valuable and rare can lead to the creation of competitive advantage that advantage, can be sustained over longer time periods to the extent that the firm is able to protect against resource imitation, transfer, or substitution. Empirical studies using the theory have strongly supported the resource-based view (Bharadwaj, 2000). This makes resources tradable and non-specific to the firm, and capabilities as firm-specific and are used to engage the resources within the firm, such as implicit processes to transfer knowledge within the firm (Makadok, 2001; Hoopes, Madsen & Walker, 2003).

This distinction between resources and capabilities has been widely adopted throughout the resource-based view literature (Makadok *et al.*, 2001; Barney, Wright & Ketchen, 2001). In their analysis of the sources of firm comparative advantage, Makadok (2000) suggested that firms utilized resource-picking and capability-building mechanisms to sustain superior performance. Resource-picking mechanisms are associated with

the superior procurement of rare, valuable, and inimitable resources, whereas capability-building mechanisms are associated with the integration of different resources with organizational structure, culture, and history to create inimitable capabilities. Consistent with these ideas, IS management researchers have conceptualized IT capabilities as associated capability-building processes and defined them as managerial skills for the acquisition, management, and use of IT in key business processes and strategies and include IT infrastructure capability, IS-business partnering, solutions delivery, vendor partnering, and strategic planning as key IT capabilities (Bharadwaj, Sambamurthy & Zmud 2002; Weill *et al.*, 2002). Sambamurthy *et al.* (2003) proposed that IT capabilities are antecedents of higher-order business capabilities in the form of digitized processes, knowledge management systems, and agility capabilities.

1.2.3 Dynamic Capability Theory

The dynamic theory regards firm's ability to constantly adapt, renew and reconfigure their capabilities and competences as the major source of performance (Teece, 2007). Dynamic capabilities are "the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split evolve and die" (Eisenhardt & Martin 2000). While RBV emphasizes the appropriate selection of resources, DCT emphasizes the evolvement of resources (Teece, 2007) which is significant by two processes: resource picking and capability building in the organization-learning loop. Hence, from DCT perspective, organizational resources need to be adaptive, renewable and reconfigurable to provide sustainable competitive advantage (Teece, 2007). Dynamic capabilities are common associated with dynamic environment where organizations need to keep changing its resources to suit the organization strategy at a particular circumstance (O'Connor, 2008).

Under different conditions of business environment, different types of dynamic capabilities are needed. This research takes dynamic capabilities into consideration from several points of views, for instance, the consideration of both internal and external components is taken into consideration in developing the strategic agility taxonomy. There is debate in the literature on what exactly are dynamic capabilities and thus research such as by Wang and Ahmed (2007) on the review and research agenda on dynamic capabilities, Eisenhardt and Martin (2000) entitled "dynamic capabilities: what are they?" and Winter (2003) on understating dynamic capabilities.

Wang and Ahmed (2007) suggested dynamic capabilities to relate to ways a firm conducts itself in defining dynamic capabilities as "a firm's behavioral orientation to constantly integrate, reconfigure, renew and recreate its resources and capabilities, and most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage". From this definition, it can be noted that dynamic capabilities relate to the changing environment and developing firm strengths in line with the changes in the environment. The firms' strengths are reflected by the ability to gain competitive advantage and this happens through the different response efforts. Dynamic capabilities are embedded in processing, that is, explicit structures made up of combination of resources that can be readjusted as required by the changing environment (Wang & Ahmed, 2007). Thus, capabilities refer to the firms' capacities to redeploy resources and redevelop processes in integration and adapting to the environment.

Eisenhardt and Martin (2000) argue that dynamic capabilities are identifiable processes which are visible, for example, product development, strategic decision making and alliances. Teece *et al*. (2007) suggested that processes, positions and paths available to an organization determine its

competitive advantage. That is, paths available for an organization depending on the managerial and organizational process mapped by its assets position define the competitive basis of the firm. Organizational and managerial processes enable collaboration and learning is fostered in the experience. In addition, the processes should be reconfigurable due to the required transformational capabilities because of the changing nature of the environment. On defining the strategic posture of the firm Teece *et al.* (2007) suggested that "the strategic posture of a firm is determined not only by its learning processes and by the coherence of its internal and external processes and incentives, but also by its specific assets".

1.2.4 Knowledge Management Theory

Knowledge management theory posits that knowledge be developed, discovered, captured, entered into the system, retained, utilized, transferred from ne party to another. Knowledge creation comprises activities associated with the entry of new knowledge into the system, and includes knowledge development, discovery and capture. Knowledge retention includes all activities that preserve knowledge and allow it to remain in the system once introduced. It also includes those activities that maintain the viability of knowledge within the system. Knowledge transfer refers to activities associated with the flow of knowledge from one party to another. This includes communication, translation, conversion, filtering and rendering. Knowledge utilization includes the activities and events connected with the application of knowledge to business processes (Kurt *et al.*, 2004).

The general Knowledge Model sequences the activity areas in a deterministic fashion. In reality, though, all but the most rigorously automated knowledge flows comprise complex systems that are built mostly from asynchronous processes. The model is valuable precisely because it relates the individual, highly dynamic behaviors and

processes to general activity areas and, by association, to each other. Various theories of learning, problem solving and cognition may imply specific activity patterns without necessarily organizing the key relationships and dependencies among the activity areas. The model allows analysts to trace individual knowledge flows by helping them to examine and understand how knowledge enables specific actions and decisions. Within each activity phase exists other, smaller knowledge flows and cycles. These layers span a wide range of macro- and micro-behaviors, ranging from broad organizational and multi-organizational processes to discrete actions and decisions, and include all the various intervening layers: activities, tasks, workflows, systems, interfaces and transformations (Kurt, 2004).

1.2.5. Organisation Culture

An understanding of culture is important to the study of information technology in that culture at various levels, including national, organizational, and group, can influence the successful implementation and use of information technology. Culture also plays a role in managerial processes that may directly, or indirectly, influence IT (Leidner & Kayworth, 2006). Culture is a challenging variable to research, in part, because of the multiple divergent definitions and measures of culture. Notwithstanding, a wide body of literature has emerged that sheds light on the relationship of IT and culture (Leidner *et al.*, 2006). The Contingency theory is a class of the behavioral theory that claims that there is no best way to organize a corporation, to lead a company, or to make decisions. An organizational leadership, or decision making style that is effective in some situations, may not be successful in other situations (Gateth, 2008).

1.2.7 Supply chain agility

Supply chain agility is regarded as an operational strategy, concerning customer responsiveness and flexibility in the supply chain (Prates *et al.*, 2001). The concept of agility is in the process of being

defined by both practitioners and researchers. Even though a number of definitions for agility have been posited within the last few years, a common thread focuses on being able to function and compete within a state of dynamic and continuous change. One such definition for agility is provided by the advanced research programs agency (ARPA) and the agility forum where agility is the ability to thrive in an environment of continuous and often unanticipated change. Agility includes four major dimensions focusing on inputs, outputs, external influences and internal operations (Goldman,1994) for instance (a) Outputs: customer enriching solution products, (b) Inputs: cooperating to enhance competitiveness, (c) External influences: un-predicable change and social values, (d) Internal operations: leveraging the impact of people and information.

In addition, Agarwal *et al.,* (2007) argues that drivers of agility can be determined by relationships that exist among entities within an organization. One such driver is the relationship between opportunistic customers and adaptable producers that may be defined as opportunity management. Another important linkage and driver for an agile environment is the link between adaptable producers and ceaseless technology that may be defined as innovation management.

The theoretical foundations of agility have yet to be explored and this may be a barrier to agility's progression, at least from the scientific viewpoint. Anderson (2006) points to some two barriers to scientific progress that are facing the topical field of the management of innovation and technology, even though he does mention that neither correctly identifies what must be done to realize progress.

1.2.8 Information Systems and Supply Chain Agility

A key characteristic of supply chain agility is the instant availability of information to manage an 'on demand' business operation. Information technology in SCM has changed dramatically, transforming business operations (Ghiassi & Spera, 2003; Shore, 2001) from electronic data interchange (EDI) systems and enterprise resource planning (ERP) systems to Internet and Intranet for supporting SCM (Pant *et al.* 2003, Shore, 2001). IS integration provides the basis for information sharing and exchange and organizations (Auramo *et al.*, 2005; Yusuf *et al.*, 2004). There is some evidence that the lack of information sharing and sparse information prohibit supply chain coordination and lead to greater operational inefficiencies (Patnayakuni *et al.*, 2006). An integrated information system requires the integration of communication, data and application (Muller *et al.*, 2007; Ross, 2003) to enable consistent and real-time connectivity among function units across supply chains (Rai *et al.*, 2006). However, IS cannot, per se, create any sustained performance or values (Powell & Dent-Micallef, 1997). Therefore, it is important for companies to integrate resources and embed them in their social and cultural context (Barua *et al.*, 2004) to develop operations and workflow coordination (Rai *et al.*, 2006).

Carr (2003) wrote a widely and deeply debated article titled IT doesn't matter. Carr noted that IT is currently the backbone of commerce but the core functions of IT namely data storage, data processing and data transportation is now available to all and, thus, not the basis for acquiring competitive advantage. The value of IT and availability means that all the players have it and this means that there are becoming costs of doing business, that is, commodity factors of production with no strategic value (Carr, 2003). Sambamurthy *et al*., (2003) suggested that IS are crucial in enhancing business performance. But even literature which concludes that IS are crucial in business, differ on how it contributes to business performance. For instance, Ordanini and Rubera (2010) noted two approaches; first, that IS indirectly impacts business performance through

several key business features, such as, flexibility. Second, approach is that IS directly enables business performance. This study inclines to the first view that IS indirectly impacts business performance through strategic agility, a business imperative of specific interest to this research.

1.3. Research Methodology

1.3.1. Introduction

The chapter describes the research design, data collection and the techniques for data analysis that was used.

1.3.2. Research design

This study employed descriptive research design modeled on case study. Descriptive research is concerned with measuring a variable or set of variables and describing them as they exist naturally answering the questions who, what, which, when, where or how much (Cooper & Schindler, 2001), making it more informative through structured questionnaires. The measurement and description of the variables was carried out both qualitatively and quantitatively to find out the effects of information systems on supply chain agility. Yin (2009) argued that when a research problem is of contemporary nature with little or no control and requires extensive in-depth description of a social phenomenon, case study could be the relevant research methodology. However the strengths and limitations of case study should be taken into consideration. The study also applied descriptive survey. In the survey, information is gathered at one point in time; survey research is sometimes referred to as a status of normative study (Kothari, 2004). Survey method was used because it allows a large amount of data from sizeable population in economical manner and it uses instruments such as interviews and questionnaires mostly, hence standardization of data which allows easy comparison. The method is easily understood and

the researcher has more control over the research process (Mugenda, 2003)

1.3.3 Target population

Sampling theory requires that all possible elements or units in the target population be identified (Mugenda, 2003). Population is any group of individuals who have one or more characteristics in common that are of interest to all researchers (Best and Kahn, 2001). Mugenda and Mugenda (2003) define population as an entire group of individuals' events or objects having common observable characteristics. However, a target population according to Kothari (2004) is the total number of respondents in the total environment of interest to the researcher. The population of interest in this study was 958 employees of The Technical University of Kenya. The institution was chosen because of practical accessibility, capacity, time and budgetary constraints. According to Cox (2010), a target population for a survey is the entire set of units for which the survey data are to be used to make inferences. According to Ngechu (2004), a population is a well defined set of people, services, elements and events, group of things or households that are being investigated. Target population constitutes the entire or totality of the items under study (Kothari, 2004) the population consisted of top, middle and lower level management groups of employees of technical university of Kenya. The institution was chosen due to proximity the researcher and their acceptance to cooperate during the study.

1.3.4 Sampling size

The sample size mainly constituted officers and their assistants whose work directly involves using technology at the institution. Customers were left out because they are not directly involved in the implementation of is in Supply Chain Management (SCM) though they are direct beneficiaries. Sample frame for this study was 10% of the target population of 958 employees and therefore 96 as respondents in line with Neuman (2003) who indicates that 10%-20% is an adequate sample in a descriptive study. According to Neuman (2003), the main factor considered in determining the sample size is the need to keep it manageable enough. Random sampling techniques require that elements in the sampling frame be assigned unique identification codes usually by numbering them from 1 to n so as to make sample selection procedure simple. (Black, 2010) In this study, the sample respondents were selected at random from members. A probability method (Crothers, 2008) was employed to get a sample of ten percent (10%) respondents.

1.3.4 Description of research instruments and data collection methods

Mutai (2000) defines instruments as tools by which data is collected. According to Mugenda and Mugenda (2003), a researcher needs to develop instruments with which to collect necessary information. The researcher developed and self-administered the following instruments to obtain the data from the respondents: questionnaires; interview guide and document analysis guide. This triangulation enabled the researcher: to obtain a variety of information on the same issue, to use the strengths of each method to overcome the deficiencies of the other method, to achieve a higher degree of validity and reliability, and to overcome the deficiencies of single-method studies.

In this study, both primary and secondary data were utilized. Secondary data was collected from the past research works, internet, relevant journals, books and publications. Primary data was used to give official opinion or position of the current respondents towards the services provided by IS in SCM (Cooper & Schindler, 2001). The questionnaires were structured in such a way that they elicited specific information from the respondents. In addition, Likert Scale attitude type of questionnaires were used to evaluate the strength of attitudes held by respondents. There were two sets of questionnaires to be filled by the respondents; one for piloting and the other set for final data collection. According to White (2000), questionnaires generate data in a very systematic fashion. Questionnaires were used in this study because they produce quick results; they can be completed at the respondents' convenience, they offer great assurance of anonymity among other advantages. It does not require that there be a visual or other objective perception of the information sought by the researcher. Attitudes and opinions are seldom learnt much other than by way of questioning (Cooper & Schindler, 2001).

1.3.5 Pilot testing

A pretest prior to the actual study was conducted to enable the researcher to purify the instrument and establish content validity, reliability, clarity of the instrument and its ease of use. A pilot of 10 respondents were asked to complete the questionnaires and rate on the degree of relevance of each item of measuring the underlying constructs on the scale from 1-5 with 1 being "not relevant" and 5 highly relevant as well to provide additional comments on every aspect of the instrument such as format, content, comprehensiveness and ease of completion. According to Mugenda and Mugenda (2003), 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 purpose the acceptability of a measuring instrument was tested on the principles of adherence to the standards of perfect reliability, confirmed practicability and verified validity. For instance, practicability is concerned with a wide range of factors of economy, convenience and interpretability (Kothari, 2004). The questionnaires were revised to reduce cases of ambiguity. According to Mugenda and Mugenda (2003), validity refers to the accuracy and meaningfulness of inferences, which are based on the research results. Validity is concerned with whether the concept really measures the aimed concept. Reliability of an instrument is the measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda & Mugenda, 2003). In order to test the reliability of the data collection instrument (internal consistency), Cronbach's alpha was used. Cronbach's alpha is a coefficient of reliability that gives an unbiased estimate of data generalizability (Zinbarg, 2005). An alpha coefficient of 0.75 and higher which was achieved in this test indicated that the gathered data was reliable as it had a relatively high internal consistency and can be generalized to reflect opinions of all respondents in the target population, (Zinbarg, 2005).

1.3.6 Data Analysis Methods and Presentation

Content data analysis is the main data analysis technique used in this research. Content analysis is a structured research tool for studying recorded communications and used for deriving meaning and relationships. In this research, this technique was used to analyze data from interviews and documents. Neuendorf (2002) defined content analysis as "a summarizing, quantitative analysis of messages that relies on the scientific method (including attention to objectivity, inter-subjectivity, a priori design, reliability, validity, generalizability, replicability, and hypothesis testing" and is not limited as to the types of variables that may be measured or the context in which the messages are created or presented.

Larsson (2006) indicated that data analysis is the process of breaking complex information or substance into smaller parts to gain a better understanding of it. The data that was collected was checked adequately for reliability and clarification. The data was then coded to enable the responses to be grouped into various categories. Data was grouped into frequency distribution to indicate variable values and number of occurrences in terms of frequency. The data was then analyzed using quantitative (multiple regression and factor analyses) and qualitative techniques.

1.4 Results of Finding

The study had 96 respondents in total sampled from a population of 958 possible respondents. The respondents' gender composition was 59.4% male and 40.6% female. In terms of departmental representation 45.5% were non teaching staff, 40.6% were teaching staff, 5.2% were departmental heads while 8.3% were in administration. All respondents were involved in the supply chain and could therefore offer relevant information for purposes of this study. In terms of age, majority of the respondents (62.5%) were in the 41-50 age group, those aged 20-30 at 1.1%, 31-40 at 22.9%, and those aged above 50 years at 13.5% representation. This mixture of respondents is quite diverse making it quite representative for the study.

The education levels of the respondents were diverse too, with 43.8% having post graduate education, 33.3% of the respondents had undergraduate qualification, 20.8% of respondents had diploma education and only 3.1% had secondary education. Regarding working experience, 11.8%, 19%, 58.3% and 11.5% had working experiences of 0-5 years, of working experience, 5-10 years, 10-15 years, and 15 years and above respectively. The fact that majority of the respondents had worked for between 10-15 years is an indication that the sample for the study

obtained relevant information as the respondents had adequate knowledge of the operations of the organization. Similarly the respondents could give objective answers as they understood their role in the supply chain.

1.4.1 Information Systems Management Skills

The study observed that the institution does not have a shortage of IT skilled workforce. With a mean of (2.6), respondents indicated that they disagreed with lack of skilled IT management personnel. Independent evaluation confirmed this. A small percentage of 8.33% indicated otherwise. The respondents also agreed with the fact that they are competent in the use of the internet and have experience with use of IS for training and research, learn and enjoy learning new programs and are competent in the use of IS that support SCM. Similarly, the respondents disagreed with the question that they only learn new programs if they are mandatory.

The study observed that the institution has a separate IT department as 91.67% indicated in the study. On the same note, 68-75% of the respondents indicated that the organization had a clear it strategy. In terms of outsourcing, most of the IT functions show that the organization does not outsource. Only application systems development has been outsourced more than the others. This is a clear sign that the institution has sufficient personnel with the requisite skills.

1.4.2. Information Systems Service Competence

The service competence levels of the staff at the institution can therefore be shown to be above 50%. These levels of competence imply that staff members were able to utilize the IT to carry out their operations. Coupled with the fact that the respondents indicated they are willing to learn new programs, is service competence is quite high. It was revealed that most of the IT processes are done in-house and not outsourced. IT competence was rated as quite high for the institution and can improve SC agility.

1.4.3 Discursion

The essential nature of the IS management skills could be attributed to the nature of the work at the institution where the use of IS especially for research purposes to aid training and delivery of service is expected to be quite high. In terms of Information systems management skills, the levels are high given the nature of the organization. This should however be separated from under-utilization of IS. However, the drawback of IS, is the nature of Information systems management platforms which are not organization-wide with key departments using standardized packages instead of ERP systems or modules. This curtails database integration thereby compromising sc agility. This implies that the organization needs to incorporate all staff in its activities to improve its SC agility. The above observations are supported by the findings which showed that IT is ranked as fifty in the middle to top   levels. This can be interpreted to mean that top management places a premier on IS as part of the key processes that drives operations of the institution.

Regarding IS Service competence, the fact that an IT teaching institution has no customized or locally developed IS system displays very little IS service competence of the staff with special regard to their creativity and innovation which are the driving factors in IT and contemporary IT breakthroughs globally and locally. This somehow waters down the IS service competence level of above 50%. This means that in as much as the IT service competence is quite high, it still requires some adjustment to reach a global benchmark or threshold such as production of IS applications for sale to organizations and companies.

1.4.4 Summary of Findings

The findings were organized in line with the specific objectives of the study in the following format. Regarding the first objective which was to determine the role of Information systems service management skills on supply chain agility, the

study found that information systems service management had a positive effect on supply chain agility based on network management enhancing collaborative abilities, security administration enhancing speed and efficiency of supply chain, remote access administration enhancing strategic response to our supply chain, data centre management enhancing virtual integration and contributes to quick service delivery to the students and staff, education level of IS personnel contributing to quick service delivery, and experience of IS Staff contributes to high performance of end users. Even in these, the respondents noted some factors were more critical than others. On the second objective which sought to investigate the role of Information systems service competence on supply chain agility, the findings revealed that adequate number of staff in IS enhances efficiency and speed of use, top management support enhances supply chain speed and efficiency, low response time to IS problems enhances speed and efficiency of the IS made IS to impact on supply chain agility through a direct positive relationship.

1.5 Conclusions

This study sought to establish the role of information systems on supply chain agility. The study was a case study of the Technical University of Kenya, a fairly young university that received its Charter in 2013. From the observations made, the university has embraced information systems though the nature of information systems used is still fragmented and details are as summarized in subsequent paragraphs. On the role of information systems service management skills on supply chain agility, the study observed that they have a major role to play on SCA. The study noted that the institution has no shortage of IS service management skills as most of the information systems management is done in house. The institution has an in-house team of skilled personnel who carry out most of their IS service

management. However, the presence of skilled personnel has not translated to supply chain agility as the platforms used still make the integration of data from all departments in the university and other stakeholders difficult. The study also observed a trend where the institution outsources its application systems development, network management and to a certain extent data management.

While this could be a plus as it frees the internal staff to carry out more crucial IS management operations, it does not anchor well for the future of the institution as it can become hostage to outsiders. This has a dual effect with both positive and negative consequences. While organizations may outsource some crucial functions, internal capacity should be developed to prevent the organization being held hostage by external stakeholders (suppliers) therefore affecting supply chain agility. The study observed that competence plays a crucial role on SCA. Competence of staff implies that they are able to fully utilize IS and therefore increase scale.

The study observed that competence levels at the institution were above (50%) which means that on a scale of (1-100), the staff could be able to utilize (50%) of the features in the information system platforms, and being a learning institution, a score of (50%) competence shows that the staff are able to utilize their knowledge to improve on the competence and service levels and by extension improve the agility of its supply chain. This is in line with Tippins and Sohi (2003) who defined service competence as the extent to which a firm can effectively utilize IS to support their business and facilitate operations this means that service competence plays n important role and enhances business performance and improve agility in the organization.

Information Systems is one of the strategic tools for the improvement of supply chain agility. The concept of Information Systems as a strategic tool for business competitiveness persists against all the scholars who contend this arguing that it can be

accessed by all competitors. Its persistence to be critical to the gaining of competitive edge over competitors lies in the differing levels of understanding and utilizing it such as customization or integration, its security among others as found in the study. This study found Information Systems to have a key role in shaping the supply chain of the institution.

The presence of an internal network in place in the firm connected through both cable and wireless connections facilitates its IS though it was noted as fairly down most times thereby lowering supply chain agility from the users side. However, it should not be perceived that Information Systems is the one and only solution to the challenge of supply chain agility as other factors were cited by the respondents as impeding supply chain agility. Such factors included transparency, lack of the required resources, especially financial, inappropriate reward schemes, and lack of good motivation schemes just to mention but a few.

Based on the findings (R = 0.925), this study therefore concludes that IS remains critical on supply chain agility and has to be given its rightful place by the institution if it has to improve its supply chain agility. This implies to all organizations, be they public or private due to the resulting roles on supply chain agility.

1.5.2 Recommendations

Based on the findings and the conclusions, the following recommendations can be suggested to management, staff and other stakeholders; In line with Li and Nagel (2011), this study recommends that resources, that is, people, machines and the necessary application software must be available to ensure SCA. Based on the findings, this study recommends that due to the fact that Information System is a constantly changing field, employees of the institution require some regular update/training to boost their skills and basic maintenance skills of their computers and consequently improve their competence thus increasing supply chain agility. To be at par with the contemporary world as a higher learning institution of the modern time, institutions incorporate social media and cloud computing in its supply chain in order to improve its speed, security and hence agility.

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Table 1 : IT Services management skills and Supply Chain Agility

	IT Services management skills and Supply Chain Agility	Very High extent (1)	High extent (2)	Not at all (3)	Low extent (4)	Very low extent (5)
1.	Education level of IS personnel contributes to quick service delivery to the students and staff					
2.	Experience of IS Staff contributes to high performance of end users					
3.	Number of staff in IS enhances efficiency and speed of use					
4.	Top management support e.g. through training of IS staff and resource provision enhances supply chain speed and efficiency					
5.	Low response time to IS problems enhances speed and efficiency of the IS thus impacting on supply chain agility					
6.	On-going learning/training enhance competence and consequent supply chain agility					

Table 2: IT Service Competence and Supply Chain Agility

	IT Service Competence and Supply Chain Agility	Very High extent (1)	High extent (2)		Not at all (3)	Low extent (4)	Very low extent (5)
1.	Our data centre management enhances virtual integration contributes to quick service delivery to the students and staff						
2.	Application system support/development Enhance knowledge sharing and organizational learning						
3.	Our network management enhances collaborative abilities						
4.	Our security administration enhances speed and efficiency of supply chain						
4.	Remote access administration enhances strategic response to our supply chain						

Table 3: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.35	2.736		1.590	.000
	IT services Competence	.515	.247	.689	2.084	.041
	IT services Management	.523	.455	.621	1.149	.044

a. Dependent Variable: Supply chain agility

Table 4: Factor Summary and Interpretation

Factor	Variable	
1	Our network management enhances collaborative abilities	IT Service Competence
	Our security administration enhances speed and efficiency of supply chain	
	Remote access administration enhances strategic response to our supply chain	
	Our data centre management enhances virtual integration contributes to quick service delivery to the students and staff	
	Education level of IS personnel contributes to quick service delivery	
	Experience of IS Staff contributes to high performance of end users	
2	Adequate number of staff in IS enhances efficiency and speed of use	IT Services Management Skills
	Top management support enhances supply chain speed and efficiency	
	Low response time to IS problems enhances speed and efficiency of the IS	