

Mapping the Internal Supply Chain for Educational Institutions. A Case Study of Kwame Nkrumah University of Science and Technology

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Abstract

Tertiary education plays a major strategic role in national development and economic growth. Public universities now have to manage their institution efficiently in line with limited funding and growing competition from the growing private universities. Universities therefore have to find the best business practices to improve on its internal operational efficiencies. Identifying and understanding the Internal Supply Chain (ISC) Frame work of an organization is an effective management tool. The study is an exploratory one mainly because of scanty literature on supply chain management in the education sector. The study adopted the case study method, using the Kwame Nkrumah University of Science and Technology (KNUST). Data was collected from both primary and secondary sources. Data collected through semi-structured interviews for specific academic and administrative staff. The study revealed that a value chain existed for the internal operations of KNUST and also an ISC framework for KNUST's processes was possible and a map also identify that the ineffective flow of information within the university seems to affects its operations. It was recommended that for efficient operation of the Internal Supply Chain (ISC) of KNUST, there needed to be optimal information flow as well as materials (Human, Financial and Physical resources) flow throughout the university.

Keywords: Supply Chain Management, Internal Supply chain, Education, Value chain.

1. Introduction

Education is the bedrock for social and economic development of every nation. It is the building block for the future sustenance of generations. John F Kennedy puts it best in his famous quote, "Our progress as a nation can be no swifter than our progress in education. The human mind is our fundamental resource."(US Congress speech, 1961) It is to this effect that tertiary education has become a pivot in the educational system of Ghana and consequently in the national development. Thus it is vital for universities to improve their operational efficiencies using management concepts. One of such management concepts is Internal Supply Chain Management (ISCM), which is one of the Macro processors of Supply Chain Management (SCM). (Chopra et al, 2007).

A firm's internal supply chain refers to the chain of value-creating activities or functions within an organization or company that aims at providing a product or service to customers, thus it deals with all process that are internal to the firm. The Educational set up, tertiary especially, has not necessarily applied the supply chain models used for industry which helps eliminate waste, create effective collaborative processes and give a comprehensive competitive advantage and thus this paper aims at mapping out the internal supply chain for educational institutions, especially the tertiary institutions and also to ascertain the value chain in university educational system.

2. Literature Review

2.1 Supply Chain Management

There are varied definitions of supply chain with various focuses but all leading to the chain activities adding value and the organization or company striving for competitive advantage. It is important to differentiate between a Supply Chain (SC) and Supply chain Management (SCM). Supply Chain is a set of organizations directly linked by one or more of the upstream and downstream flows of products, services, finances, materials and information from a source to a customer. It is the management of the supply chain that is referred to as 'Supply Chain Management' (SCM) (Mentzer *et al.*, 2001)

SCM deals with a network of businesses and relationships; both intra and inter organizational integration and management (Lambert, 2006). The Global supply chain forum defines SCM as "the integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders" (Lambert et al, 1998)

This definition focuses on the essence and role of value creation using the key business processes which cut across every organizational setup; profit and non-profit as well as the service industry. Consequentially, it is appropriate to say that SCM definitely applies in Educational institutions.

Another definition states that, SCM is the systematic, strategic coordination of the traditional business

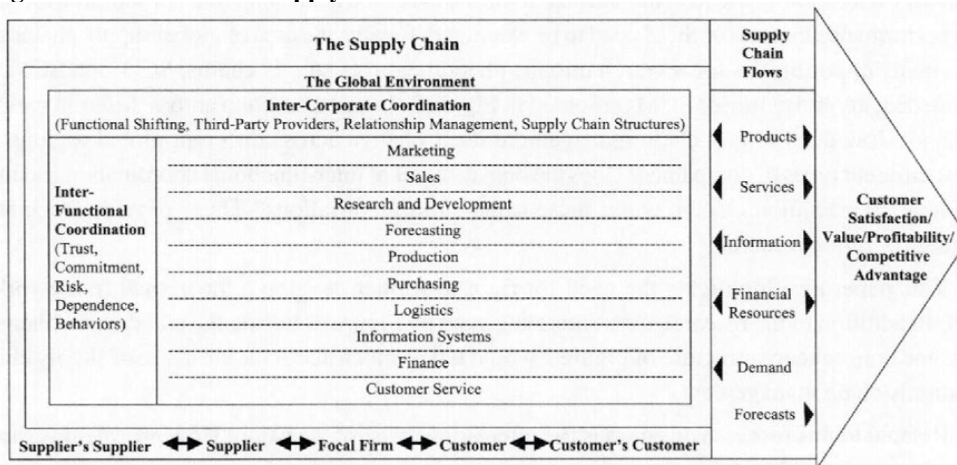
functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the supply chain. (Mentzer *et al.*, 2001). This definition places emphasis on the management of the business functions and processes in order to improve performance of an organization in the long term. Awad et al also defines SCM as, “A system that facilitates inter-enterprise cooperation and collaboration with suppliers, customers, and business partners.” This definition identifies the various stakeholders in every organization and these can also be identified in higher educational institutions.

Hines (2004) ascertains that “Supply chain strategies require a total systems view of the linkages in the chain that work together efficiently to create customer satisfaction at the end point of delivery to the consumer. As a consequence costs must be lowered throughout the chain by driving out unnecessary costs and focusing attention on adding value. Efficiency within the chain must be increased, bottlenecks removed and performance measurement must focus on total systems efficiency and equitable reward distribution to those in the supply chain, adding value and also the supply chain system must be responsive to customer requirements.”

2.2 Supply Chain Frameworks

There are several SC frame works notable amongst them are the Global Supply Chain Forum Model and the Mentzer Model. Figure 2.2.1 depicts the Mentzer SCM model which was developed by Mentzer et al. (2001), based on their definition of SCM as, ‘the systematic, strategic coordination of the traditional business functions and tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long term performance of the individual companies and the supply chain as a whole.’ According to this definition the Mentzer Frame work involves several firms and multiple activities within the business, as well as practices that coordinate activities across functions and across firms within the supply chain. This framework presents SCM in a pipeline format depicting the SC flows, inter-functional coordination of traditional business functions, and the inter-corporate coordination between supply chain partners. Thus the framework focuses on cross-functional interaction within a firm and on the relationships developed with other supply chain components.

Figure 2.2 The Mentzer Supply Chain Model



Source: Mentzer *et al.*, (2001)

The Global Supply Chain Forum Model identifies eight processes which are the pillars of SCM (Lambert, 2008). The eight key business processes are; Customer Relationship Management, Customer Service Management, Demand Management, Order Fulfilment, Manufacturing Flow Management, Supplier Relationship Management, Product Development & Commercialization and Return Management (Cooper et al. 1997). It is important to note that each of these processes runs cross-functionally within an organization. Customer relationship management and supplier relationship management are the links to the external companies within the chain and the other processes are the internal processes related to the organizations ISC (Croxtton et al, 2001).

2.3 Internal Supply Chain Management

The concept of Internal Supply Chain Management (ISCM) is encompassed in the three main supply chain macro processes, Customer relationship management (CRM), Internal Supply Chain Management (ISCM) and Supplier relationship Management (SRM) as indicated by Chopra et al, (2007). Internal supply chain refers to the chain of activities or functions within a company or organization that concludes with providing a product to the customer (Basnet, 2010). This process therefore involves multiple functions within organizations or

companies that transform raw materials to finished products. ISCM entails managing functions and processes within and along, departments or business units in an organisation or company with the aim of maximizing integration and synergy and more importantly satisfying all stakeholders. SC performance is always improved through better use of internal and external capabilities creating a seamlessly coordinated supply chain, elevating inter-company competition to inter-supply chain competition (Burgess et al., 2006; Lummus and Vokurka 1998; Mentzer 2004; Lambert 2008). SCM is used to describe work aimed at breaking down the barriers between functions within organizations or companies. Porters, (1995) indicated that sustainable competitive advantage results from managing linkages within an organization primarily before focusing on the external linkages. There must be a clear understanding of the internal processes to ensure efficiency within first, the organization and then its other entities that make up its SC. A firm's internal supply chain as explained by Basnet et al., (2010) refers to the chain of value-creating activities or functions within the company that conclude with providing a product or service to the customer. Integration of these functions involves holistic performance of activities across departmental boundaries.

2.4 Supply Chain Management in Education

SCM in education is a fairly innovative concept being used to adopt business and industry models in higher educational management. SCM has been linked with different management areas mostly with the manufacturing industry and to some extent some large service delivery companies. The focus has mainly been on profit making organizations, whereas Educational institutions are Service industry in a non-profit making environment. It is important to highlight the differences between service supply chains and the more traditional manufacturing supply chains. In service supply chains, human capital forms a significant component of the value delivery process and while, physical handling of a product leads to standardized and centralized procedures and controls in manufacturing supply chains, in services this is not entirely possible as many of the decisions are taken locally and the variation and uncertainties in outputs are higher because of the human involvement. Also, the focus of efficiencies in service supply chains is on management of capacity, flexibility of resources, information flows, service performance, material flows and cash flow management but these issues are quite different from manufacturing supply chains. (Ellram, Tate and Billington, 2004). Ellram et al., in their study of service supply chain, highlight the rising importance of the service supply chain. They involve the concept of service performance and capacity to facilitate the distinguishing between services and manufacturing. In the Service SC, Service performance ensures the customer receives the expected service with capacity serving as a substitute for inventory. For a service organization, the strategic use of capacity facilitates operational dexterity. They propose a supply chain framework appropriate for a service supply chain by comparing and contrasting two well-known product-based manufacturing models; the Global Supply Chain Forum Framework, and Mentzer Framework SCM Model and they conclude there is the need for more service supply chain related research.

The main focus of higher or tertiary education is to provide relevant research, training and a conducive learning environment key to intellectual growth and Socio-economic development of nations. It is important to note that SCM aims mainly at cost reduction, reduction of lead times, reduction in transactions, release of value, ensuring appropriate quality in the environment of proficient information and materials flow especially amongst internal processes and the various stakeholders. (Fisher 1997; Lambert et al. 2005; Lee et al. 1997; McCarthy and Golicic 2002; Sabath and Fontanella 2002; Stank et al. 2001; Tan et al. 2002; Tummala et al. 2006). These principles are also of prime importance to tertiary educational organizations in their management goals, mainly to manage the limited funding from Government and private sources and to handle their ever increasing student population whilst ensuring timely, quality educational delivery and ensuring the operations and procedures of the administration and management of the university is done in the most efficient and optimal manner.

Quite a few studies have been conducted in Educational Supply Chain Management and limited findings exist. Notable among the few studies are the study on the City University of Hong Kong by Antonio K Lau and also the study by Elaine O'Brien and Kenneth Deans on the University of Strathclyde, UK. With the study of the City University of Hong Kong, three main supply chains were established; The 'Student' Supply Chain, the 'Research' Supply Chain and the 'Generic' Supply Chain which entails their Procurement Processes and types.

2.4.1 The Student Supply Chain

The student supply chain of University of Hong Kong gives a framework of a supply chain network for students in the university.

The 'Student' supply chain of the City University of Hong Kong indicates the following:

1. The raw materials are the Students
2. Students as raw materials are processed through the various Student Services which are:
 - a. Student design and development as well as Student sourcing and selection (Admissions)
 - b. Student Academic training; lecturing and course work
 - c. Student non-academic training; socialising, sports and counselling services

- d. Student practical Training: Final year projects and thesis, assignments, reports, industrial training and exchange programmes
- e. Student result and academic testing through examinations.
- f. Student career development and internships and recruitment training
- g. Student advance development like post graduate studies and research study and works
- h. Student social development like alumni connections, development in society and further career development.

It is to note that apart from the direct student services listed above Lau's,(2007) asserts that, there are crucial indirect student services such as Campus advancement, development and maintenance, hall and hostel accommodations, IT infrastructure, Bookstores, Sports facilities, entertainment or social facilities, restaurants and security

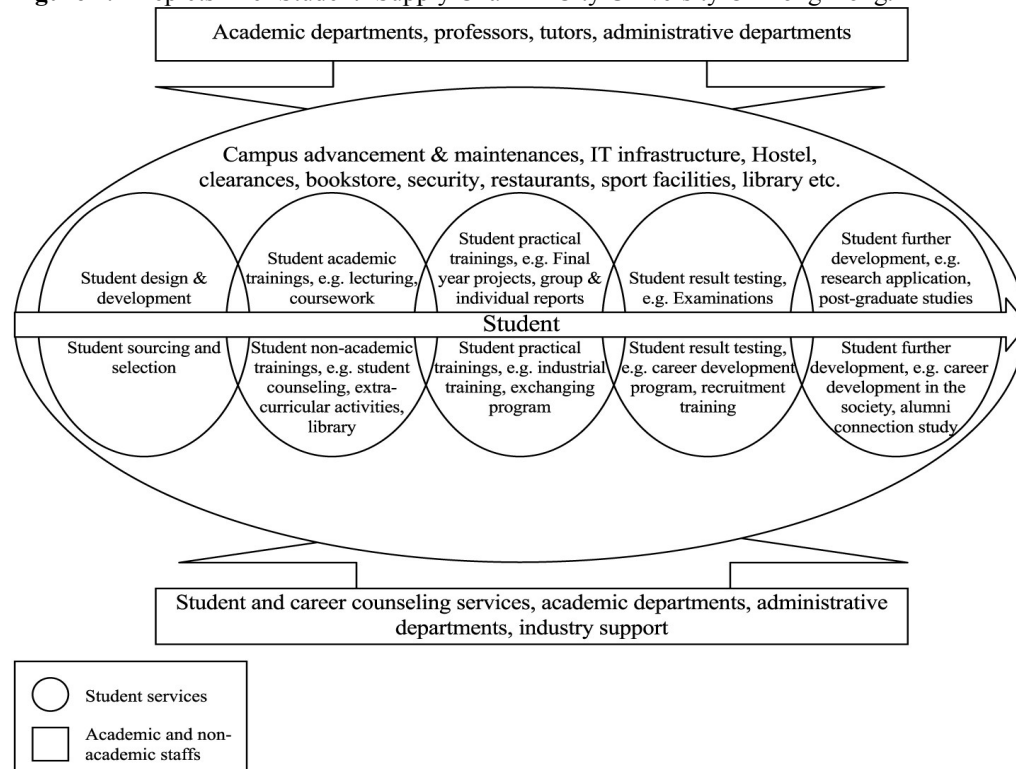
3. The Operators of the Student service processes are the Academic and Non-academic staff

4. The finished goods of the SC are the graduates (processed Students)

The goal of the City University of Hong Kong Student SC is to supply to society which is also both the supplier and consumer with well-trained graduates amidst limited resources.

This scenario is replicable and applicable to all university systems and clearly determines a distinct Supply chain model.

Figure 2.4 Depicts The 'Student' Supply Chain in City University Of Hong Kong.



Source: Antonio K Lau, 2007

2.4.2 The Research Supply Chain

The second core process in the City University of Hong Kong is Research and its supply chain frame work is shown below.

The 'Research' supply chain of the City University of Hong Kong indicates Research Idea as the raw material to the Research SC. Research activities such as Generation of research idea, Instrument development, Data collection; analysis and findings, process the research Idea. Thereseachersss, other academic and non-academic staff as well as industry are the operators of the research activity processes. The Research achievement is the finished product of the Research SC.

Research plays a very vital and critical role in the functioning of all universities. Research aims to add knowledge to existing knowledge both to academia and society in general. Research is defined as 'seeking through methodical processes to add to one's own body of Knowledge and, hopefully, to that of others, by the discovery of non-trivial facts and insights' (Sharp and Howard, 2006). Research also forms a linkage between the university and industry which then presents a platform for collaboration (Santoro and Chakrabarti, 2002; Lambert, 2003, The Royal academy of Engineering, 2007)

Since all universities thrive on some amount of research that they propagate and feature in various journals

academically, it serves therefore as a pivot in the university growth and development. It is therefore appropriate, identifying the research supply Chain in every university using the City University of Hong Kong model.

2.4.3 Procurement in the City University of Hong Kong's Supply Chain

The Generic Supply Chain of City University of Hong Kong indicates the two sources of purchasing or procurement activities of the university and outlines the related processes. External Suppliers are the suppliers or business organizations which supply the university with commodities, special good and equipment and those to whom certain special students services such as bookstores, restaurants, hostels to name a few, are outsourced. The basis of most purchases is based on forecasts from previous years and focus on cost effectiveness using aggregate quantity for purchases. The Internal Customers of the Generic SC are the Students, researchers, academic and non-academic staff. Internal suppliers, here refers to the various collaboration between the various faculties and departments within the university which share resources such as Professors lectures or specific techniques. Thus the internal supplier supplies to the internal customer of the Generic activities within the generic SC the ISC activities are the SC processes, which consist of order processing, supplier selection, supplier relationship and negotiating with suppliers.

2.5 University of Strathclyde's Supply Chain.

The study of the University of Strathclyde's SC affirmed that the focus of students as inputs or suppliers to the university SC was changing from students who sort university educations as their main objective in quest of knowledge and becoming learned, to students who sort university education with their future career in mind. That is, they sought education to seek employment and saw their tertiary education as a stepping-stone to employment. (O'Brien et al, 1996; Veazquez et al, 2005). Students were also categorized not only as input, but as output and part-consumer of the SC. Also it identified the student as the university's main customer and industry, businesses and employees as the secondary customer. (O'Brien et al, 1996)

The concept of adding value which is one of the objective of effective SC as noted in Education SC is eminent in the various additional services that are being offered by universities such as, Industrial placements, internships, mentorship programs, student affiliation with professional bodies and assess to powerful Alumina.

The linkages noted in the SC of University of Strathclyde were the various collaborations between the university and various units within it as in the colleges and faculties and the alliances with other external colleges and institutions.

The challenge to the SC of University of Strathclyde is the management structure, which does not push for a more proactive approach to changes in the university environment, both external and internal. Goral, (2008) identifies another focus for tertiary education (Public) as decreased government funding with the growing need to improve facilities and services and also attract both top academic and non-academic staff and brilliant students. Another view also states that 'The college or university experience has expanded from simple educational institutions to full enterprises, akin to a country club resort complete with all amenities' (Cotton, 2003)

The needs of students, their families, benefactors and sponsors are also changing from only seeking the education, to seeking for value and quality in state of the art facilities, accommodation facilities and technological infrastructure the universities have. (Comm et al, 2007). Basically students are also seeking value for money.

2.6 Higher Education using Walmart Supply Chain Management

In C. Comm and D Mathaisels 'Sustaining Higher Education using Wal-Mart's best Supply Chain Management practices' they identified the consumers of Educational SC as the Students and their parents and the university as the supplier. The benchmarking of Wal-Mart's best SC practices which are; Strategic concept, logistics and distribution, Information Technology and supplier collaboration in relation to educational SC would be productive and lessons could be learnt. Wal-Mart's strategic concept is based on cost control to maintain low prices to maximise their Sales and Revenue. This strategy is in line with the goal of SCM, which is to "increase throughput while simultaneously reducing both inventory and operating expense" (Goldratt, 2004).

The second practice, Logistics and distribution are the core of Wal-Mart's expertise in SCM. Wal-Mart prides itself in the effective growth strategy of its distributions centres in relation to providing its customers with the right goods at the right time at the right place maximizing efficiency.

The third fundamental best practice to Wal-Mart's SCM expertise in SCM is its information systems and supporting technology. It is used for inventory control and to track and share information throughout the SC. It is also used to manage data for forecasting and noting customer behaviour in association with trends.

Wal-Mart's supplier relationship management has been very important to its SCM. The company is a very tough negotiator especially in pricing and delivery procedures. This also provides Supplier with very large orders and fast payment of invoices. (Fishman, 2003).

Wal-Mart's best SCM practices can be used by university institutions in their SC as determined by the RAND study of the US system of *higher education* and Foundation for Independent Higher Education focused

on college cost containment efforts in 630 member institutions in the US. The study identified outsourcing, technology initiatives, and collaboration as the three key methods that public and private Institutions of higher education should and can use to contain costs and improve efficiency in their value streams (Kaganoff, 2004). It is important to note that these three methods directly relate to the Wal-Mart principles and can be adapted by university management in its SC as explicated below:

- **Outsourcing:-** Outsourcing allows schools to hire a third-party business to manage and operate a non-core competency for the institution (Jeffries, 2010). Services that can be outsourced are Hostel facilities, Bookshops, cleaning and maintenance teams, Catering and Restaurants and part time faculty. This allows for the university to focus on its core activities.
- **Technology:-** The past two decades have been marked by the rapid evolution of IT into the education of our students. But, the real IT issues are not about the products, but rather about the focus on the effective use of IT resources and the effective delivery of IT services – how IT aids and advances the institutional mission (Green, 2007). It has provided faster access to data and information and helped in developing research ideas faster. The internet has created several educational platforms in integrating the educational systems both internally and externally. The internet has also facilitated online education and distance learning programs. This however does come with a cost however a recent cost-benefit analysis has shown that maintaining high technology is a worthy and justifiable investment if a school is to be sustainable and competitive (Kaganoff, 2004)
- **Collaboration:-** Collaboration on several levels can help the universities remain cost effective and adapt easily to changing trends. In the public sector, universities use centralized purchasing for all the departments in their system to save money and cut cost. In terms of faculty collaboration, many colleges are now offering courses in modules and using team teaching. This means that that faculty (academic) can be shared across departments/divisions for more expertise in various subjects and courses.

An example of building collaboration among public campuses with distinct identities in the public sector is the University of California system. It has annual conferences with students, faculty members, and administrators from each of the campuses to build community among the campuses for certain policies like tenure and promotion, compensation, benefits, and intellectual property. Otherwise, its ten campuses are independent of each other. (Comm et al, 2007) This is similar to the college system run in KNUST.

The Wal-Mart SC expertise showcases the opportunity that Tertiary education as a service industry can benefit from mapping out its SC. The SC would then aim at efficiently linking; Faculty, Students, staff, administration, Product and equipment suppliers, industry, government and various intermediaries, in order to decrease cost, add value to all stake holders (students, parents, academic and non- academic staff, industry and society) thereby creating synergy.

It is thus obvious that SCM has a role to play in Education as a management tool to ensure educational institutions are run efficiently and effectively, costs minimized and value created throughout the system.

2.7 Internal Supply Chain Management in Education

Though studies of ISC are relatively new in the SCM context (Giménez, 2004; Giménez and Ventura, 2003; Pagell, 2004), there have been many earlier studies in the area of inter-functional integration in the contexts of new product development and the production-marketing interface (e.g. Calantone *et al.*, 2002; Kahn, 1996; Kahn and Mentzer, 1996; Mollenkopf *et al.*, 2000; Stank *et al.*, 1999). SCM literature suggests that various companies have different levels of adoption of specific SCM strategies, which result in varying levels of organizational performance with ISCM being one of the strategies. (chen et al., 2004)

2.7.1 Internal Supply Chain and the Educational Process

There is quite a limited literature on ISC in education however inference can be made from literatures associated with the service industry. Since ISC refers to the intra-organizational functions and processes and identifies the various linkages within the organization's processes, identifying the various functions or departments and internal processes within the university would help replicate the processes from the physical product based organization.

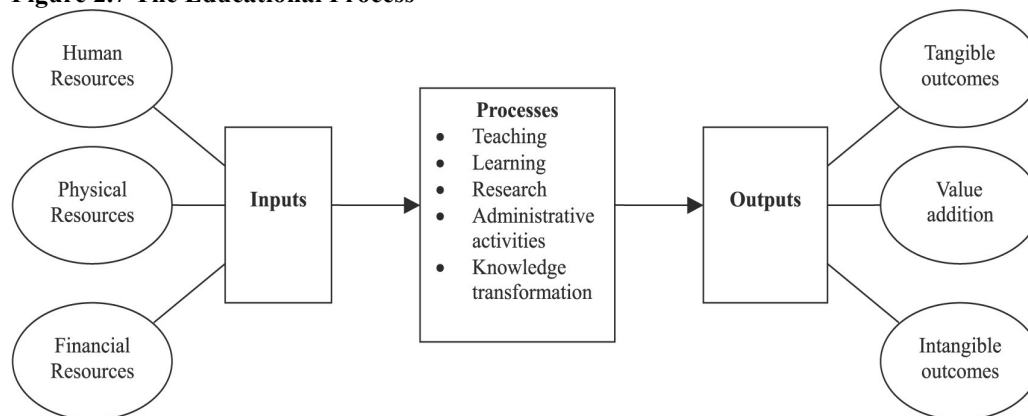
Literature on higher education and the various management tools which are employable all point to one fact that all stakeholders within the educational process are seeking value for money through efficiency and effectiveness (Schrock and Lefevre, 1998).

The Internal processes which are the determinants of the ISC in tertiary Education were stated by Divorky et al, as 'a series of operations leading to an educational end-learning, training and /or scholarly activity'. The process of transforming inputs (students) through the educational process which then adds value to hence presenting them as outputs (graduates) was illustrated by Gupta (1993) in Figure 2.7 Gupta refers to the internal process of educational institutions as 'activities performed to disseminate knowledge, to conduct

research and to provide community service'. The educational process as depicted in Figure 2.7 is a model of ISC for education. It depicts the process indicative of the production process of a graduate, with the student being the main input and human, physical and financial resources relating to the student as supporting inputs. The processes entail the teacher, which is the academic staff, administrative staff, the physical facilities and infrastructure and research centres as well as social amenities like sports and recreational facilities.

The outputs are the students (graduate) who have gained value through the process after being assessed through examinations and continuous assessment. The graduate now has value within the society and is employable.

Figure 2.7 The Educational Process



Source: Gupta, (1993)

It is however important to note that the role of students in SC and ISC process of the Educational system is sometimes ambiguous. This is clearly stated by Sirvanci,(1996) that there is no single role that can be attached to students in the higher educational system but four distinct roles can be identified, the student as;

- i. The product in the process
- ii. The internal Customer for many campus facilities
- iii. The labourers of the learning process and
- iv. The internal customer for delivery of the course material.

Students have also been considered as primary customers, raw materials, suppliers, co-processors and products (Harris, 1992) These definitions or classification of students are indicative of the main entity for the modelling of ISCM. The need then arises for the most appropriate model for an efficient ISC system and this bothers on synergy between the various processes identified. Figure 2.4 from the previous section illustrates the Supply Chain of City University of Hong Kong, which indicates the various processes within the typical ISC of a university. This supply chain can be adopted as an effective model of ISC. It indicates the various processes that the student goes through and denotes the various operators in the process.

3. Methodology

This study is an exploratory study that seeks to map out the Internal Supply chain Management (ISCM) in tertiary education using Kwame Nkrumah University of Science and Technology (KNUST) as the study case as it represents the typical system of universities in Ghana. The choice of an exploratory study was also influenced by the fact that limited studies had been undertaken into the area of ISC in education; as such the researchers adopted this approach to have the flexibility it presents to conduct the study (Saunders, 2009). The study sought to map out the ISC of KNUST by identifying and describing the various elements within KNUST and to determine the value streams and the linkages therein.

The population of the study was made up of all academic and administrative staff of the university. The target population was the Principal Officers of the university, the Pro-Vice Chancellor, the Registrar, all Provosts of the university, all assistant registrars of the six colleges and students of the university.

The sample size is mainly a subset of the entire population and is representative of the population from which it is drawn and is used to conduct research study to derive findings that apply to the population (Castillo, 2009)

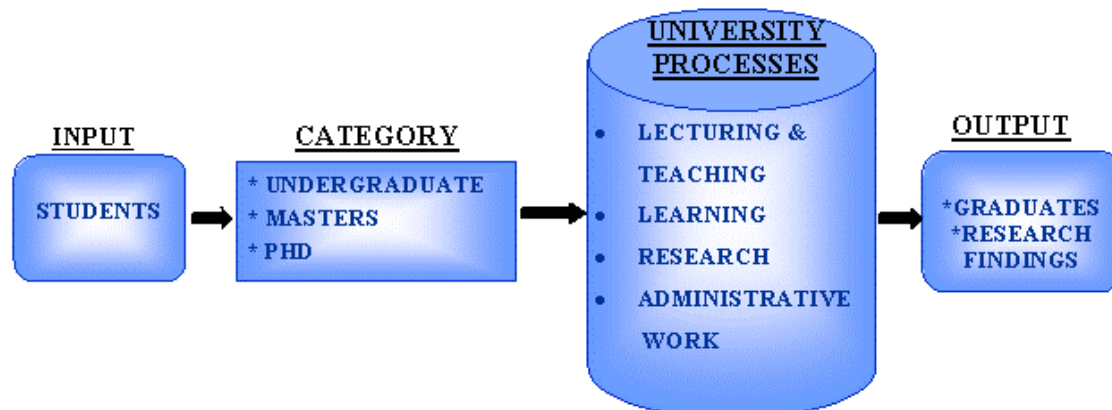
Questionnaires were purposively distributed to the Pro-Vice Chancellor, the academic and human resource registrar six Provosts and interviews also conducted whereas the students were randomly presented with fifty questionnaires. A response rate of 94% was recorded.

4. Presentation and discussion

4.1 Mapping out the Internal Supply Chain (ISC) of KNUST.

The analysis has shown that the various units identified are linked and form the various processes and functions

of the university and is used in mapping out the ISC of KNUST. Figure 4.1 depicts a mapping of KNUST's Internal Supply Chain.



Source: Authors' Construct

The KNUST ISC Mapping showcases the process of training students and conducting research. The main objective of the university is to educate students to acquire degrees (bachelors, masters and doctorates degrees) and also to conduct research. Students are the main input of KNUST, admitted to undertake undergraduate, masters or Doctorate programmes. Students learn as they are lectured and taught by their lecturers. Administrative works ensure the smooth running of the university seeing to students and staff needs and the efficient running of all facilities within the university. Research is conducted by lecturers, and student to come out with finding for the use of both academia and industry. Students pass out of the university as graduates with bachelors, masters or doctorate degrees.

Existing literature on ISC indicates that there must an input and transformation of the input into an output be it a product or service and how these are managed by an organization.

4.2. Ascertaining the Value chain of the university.

The analysis indicated that the value chain of KNUST described the varied processes, procedures and activities that the university undertakes in admitting students into various programmes and them completing these programmes as graduates and also research findings that the university embarks on.

The study indicated that there are mainly three categories of students:

1. Undergraduate (Bachelor Degrees)
2. Postgraduate (Masters and Doctorate degrees) and
3. Short Course certificate programmes.

Students are admitted to undertake programmes in one of the six Colleges of the university as main stream students or through the distance learning programme under the Institute of Distance learning (IDL).

The colleges of the university are: College of Agriculture and Natural Resources, College of Architecture and Planning, College of Art and Social Science, College of Engineering, College of Health Sciences and College of Science.

For KNUST to maintain its pedigree as the premier university in Ghana and the sub region, the university ensures it recruits the best in both academia and industry to lecture and tutor students.

Extracurricular facilities are provided to encourage student participation in socializing and individual skill development. The university has an efficient health services including a hospital and clinic to meet the medical needs of the university community.

The estate department of KNUST ensures that the university facilities are well maintained especially accommodation facilities for both students and staff. Lecture halls and auditorium are also managed by the estate department. KNUST also encourages private participation in the provision of accommodation facilities (Hostels) around the KNUST environs for students.

The library of the university provides the student with a vast resource of books, articles, journals and an online repository.

Researches are initiated by lecturers and sometimes through proposals from industry, Non-Governmental Organizations (NGO) and donor agencies.

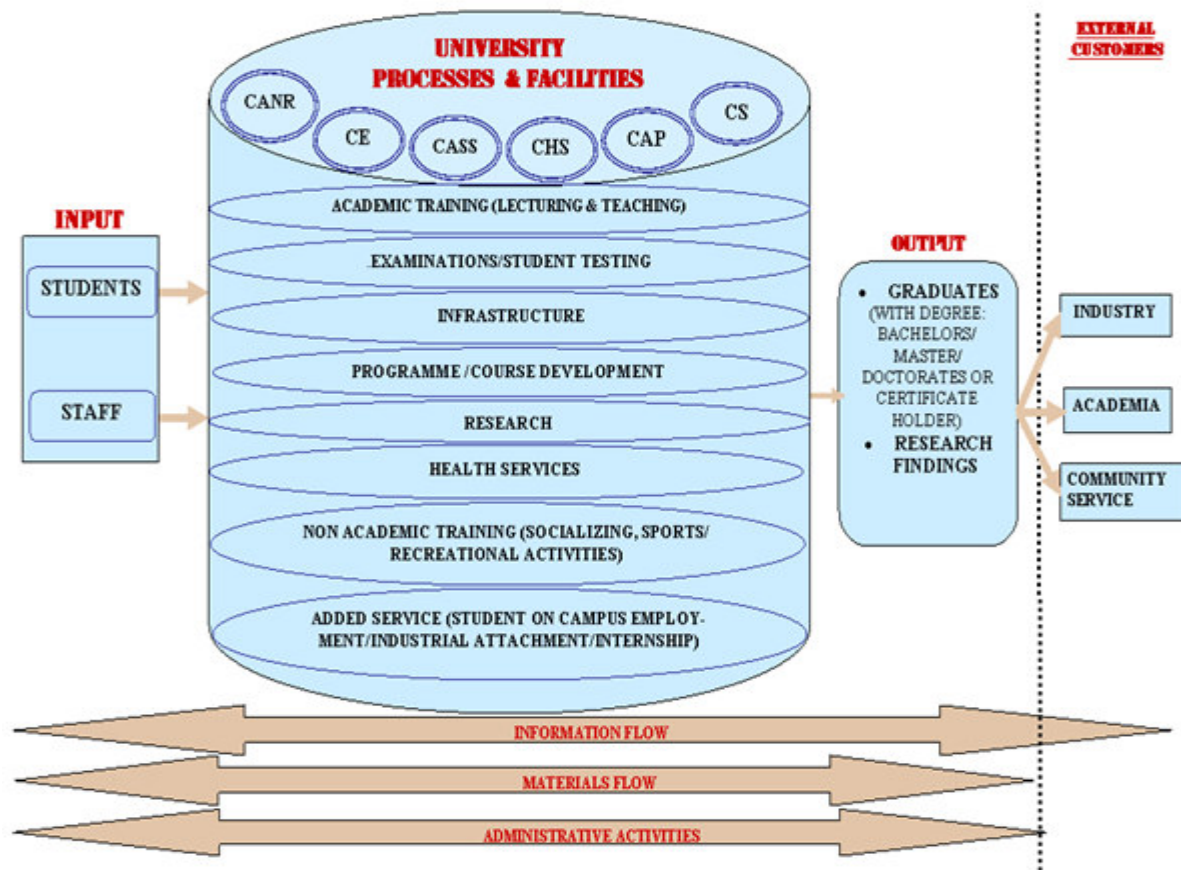
Administrative processes are structured to ensure the efficient and smooth functioning of the university. There are structures to meet the needs of staff and lecturers and ensure all facilities are in top shape. The various activities and process in the university utilizes information from all facets of the university including resources such as financial, human and physical.

4.3 The various units within KNUST

The various units within the university as identified by the researchers are, Students also known as the Junior Members, Staff consisting of Senior members, senior staff and junior staff, the various Colleges of the university, the University council and administration.

4.4 Recommending a framework for Internal supply chain management for KNUST.

Figure 4.4 illustrates the conceptual framework for KNUST's Internal Supply Chain management.



- ❖ CS:-College of Science
- ❖ CE:-College of Engineering
- ❖ CHS:-College of Health Science
- ❖ CASS:-College of Arts and Social Science
- ❖ CAP:-College of Architecture and Planning
- ❖ CANR:-College of Agriculture & Natural Resources

5.0 Summary of key Findings, Conclusion and Recommendations

The study mapped out the Internal Supply Chain Management in tertiary education using KNUST as a case study. The study aims at identifying KNUST's Internal Supply Chain, evaluating it and making recommendations.

5.1 Summary of Key Findings

From the analysis of data and information gathered it was established that KNUST does have an Internal Supply Chain Network. The study also revealed the following findings:

- Staff communicate per department and colleges within themselves effectively
- There is no information platform for the university; i.e. no enterprise-wide computer system to provide access at various levels to information amongst departments/colleges and for students.
- Activities are synchronized by all departments or colleges for the benefit of the university.
- Strategies are structured per college with staff involvement.
- Procurement processes are centralized but information on requisitions are not shared amongst other departments or colleges and delivery of requisitions are not delivered timely.
- Course content and programmes are reviewed but per department or college and with little input from

students and minimum contribution from industry.

- Funding for research is inadequate.
- ICT facilitates the admission and student registration system.
- There is no collaboration between students of the university

5.3 Conclusion

Education has become competitive by the advent of private universities and increasing number of students. KNUST therefore must, within its operations and administration, be efficient and effective in its management practices. Identifying and understanding its Internal Supply Chain can help in its management practices.

5.4 Recommendations

The study indicated that KNUST does have an Internal Supply Chain and it can be mapped out and the management practice it offers such as Internal Supply Chain Management (ISCM) can be applied. Based on the findings of the study, the following are the researchers' recommendations:

5.4.1 Enterprise-Wide computer systems (ERP) for Information flow

There must be access to information across all facet of the university by the use of both staff and students. Information is the back drop to effective communication and synchronizing of data and would help in the efficient management of the university and provide students with access to relevant information. It would also make course or programme material available to students via the university's network. It is therefore recommended that the university acquire or develop an ERP to ensure effective information flow in the university.

5.4.2 Consensus on Strategy and Objectives

The researchers recommend that there must be communication and consultation in the developing and implementation of new strategies and objectives to ensure that there is total cohesion in its execution. This also ensures that the staff, both academic and administrative feels a sense of responsibility in ensuring the success of all strategies and meeting of set targets and objectiveness. This maximises consistency amongst all stakeholders.

5.4.3 Culture of Collaboration

The researchers recommends that the functional collaboration that exists per department and colleges should be incorporated also to holistic university collaboration where there would be collaboration between the various departments, colleges and administration as well as the student body of the university.

5.4.4 Funds for Research

Since one of the main focus of higher or tertiary education is to provide relevant research to contribute to intellectual growth and Socio-economic development the nations, the researchers recommends that a sustained source of funding is sort from university-industry and university-donor agencies collaborations. To this effect the university must take the initiative to form this collaboration for the sustenance of research in the university.

5.4.5 Procurement System

The researchers recommends that the procurement system of KNUST should be computerised and a database be created that would be accessible in limits to the appropriate administrative staff per department or college so there can be consultations and synchronizations of placement of requisitions for orders.

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