

The Influential Role of Information System in Supply Chain Management

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Abstract

Information management is one of the main ingredients to a successful supply chain management and so the introduction of various information systems such as Enterprise Resource Planning Systems (ERPS), Electronic Data Interchange (EDI), Enterprise Application Integration (EAI), etc has made the global business environment very competitive and highly electronic. This has made many companies and businesses including oil marketing companies in the Kumasi metropolis to move away from some of their manual processes of doing business. The main objective of this research was to find out the influence of information system in supply chain management for OMCs in the Kumasi metropolis. The methodology used was the case study approach together with questionnaires and interviews to collect data for the research work. The sample size was sixty-one (61) which included both staff of OMCs and some respective suppliers whose information was analysed using the statistical package for social scientist (SPSS). The outcome of the study revealed that most of the Multinational OMCs use IS both internally and for their suppliers while the situation was different with indigenous OMCs in the Kumasi metropolis. Again it was revealed that some OMCs are using I.Ss but there is still the need for some education on the use, benefits and importance of I.Ss for their operations. It is recommended that the various OMCs was for them not to only look at the cost of implementing useful I.S but to first look at the benefits they stand to gain which includes a sound solution for some operational cost savings which includes maverick spending, security and problems associated with order fulfilment, loss of documents, proper inventory management, etc. Though the study concludes that IS are very vital to the success of a supply chain management, OMCs who wish to implement its usage within their operations must ensure that all players in the chain are aligned to the aims and objectives of its usage.

Key Words: *Information System, Supply Chain, Management*

I. INTRODUCTION

Supply chain management (SCM) is the 21st century worldwide operations strategy for achieving organizational competitiveness (Ngai et al, 2003). Supply Chain Management is said to be the integration of key business processes from end users through original suppliers that provides products, services, information and hence adds value for customers and other stakeholders (Lambert et al., 1998). It is obvious that companies are trying to find ways to improve their flexibility and responsiveness and in turn competitiveness by changing their operations strategy, methods and technologies that include the implementation of SCM models and information technology (Gunasekaran et al, 2004). Information management is said to be one of the major ingredients to a successful supply chain management (Mason-Jones et al, 1998). The amount of information in organizations is heavily increasing and it has become vitally important to efficiently manage and share information inside and among suppliers in the chain of the organizations operation. Organizations have to be quick in adopting new technology in order to remain competitive in a continuously developing business environment (Jern, 2009). This is where information systems (IS) come into play. Companies and other organizations are devoting huge sums in bringing to the fore information systems in the organization with the hope of being able to make business more proficient and information sharing smooth. But how influential can this be to their operations?

II. SUPPLY CHAIN MANAGEMENT

The Supply Chain Management (SCM) discuss has remained central to the Operations Management field as demonstrated by the particular issues of both Production and Operations Management Journal (POM) and International Journal of Operations & Production Management (IJOPM), in 2006, and the Journal of Operations Management (JOM), in 2007. Interest in the idea of supply chain management has steadily grown bigger since the 1980s when companies saw the benefits of concerted relationships within and beyond their own organization (Vokurka et al. 1999). Supply Chain Management, in its core, assumes that firms set up alliances with members of the same chain to improve its competitive advantage revealed by superior operational performance of all chain members. Influenced by many different fields like purchasing and logistics, the idea of SCM evolved from a process integration viewpoint to a more recent systemic and strategic view. In the process integration perspective, different members of

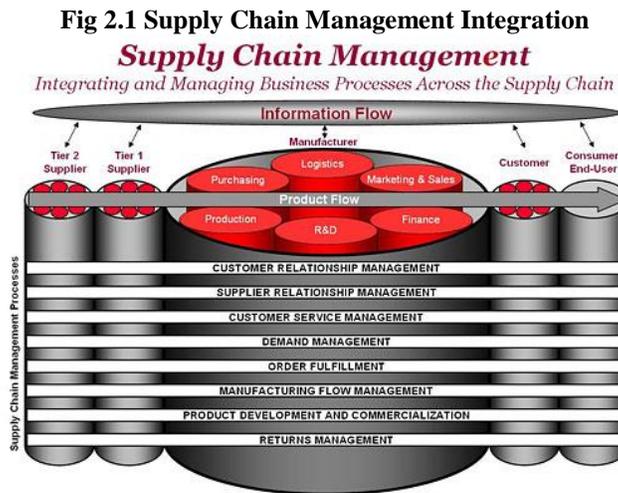
the same supply chain join efforts to coordinate specific business activities to improve final customer satisfaction (Cooper et al. 1997).

It can therefore be concluded that the term supply chain management is not used as a replacement for supplier partnerships, nor is it a clarification of the logistics function. A number of definitions of supply chain management have been suggested in this literature and in practice.

A. Supply Chain Management Defined

Many explanations have been given for the term supply chain in the past several years since it is a concept that has gained popularity. The *APICS Dictionary* describes the supply chain as: The processes from the initial raw materials to the ultimate consumption of the finished product linking across supplier-user companies; and the functions within and outside a company that enable the value chain to make products and provide services to the customer (Cox et al. 1995). Another source defines supply chain as, the network of entities through which material flows. Those entities may include suppliers, carriers, manufacturing sites, distribution centers, retailers, and customers (Lummus and Alber, 1997). The Supply Chain Council (1997) uses the definition: "The supply chain - a term increasingly used by logistics professionals - encompasses every effort involved in producing and delivering a final product, from the supplier's supplier to the customer's customer. Four basic processes plan, source, make, deliver - broadly define these efforts, which include managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer."

Quinn (1997) defines the supply chain as "all of those activities associated with moving goods from the raw-materials stage through to the end user. This includes sourcing and procurement, production scheduling, order processing, inventory management, transportation, warehousing, and customer service. Importantly, it also embodies the information systems so necessary to monitor all of those activities."



Source: Lambert et al. (1998)

B. Early Supply Chain Initiatives

The history of the supply chain ingenuity can be traced to early beginnings in the textile industry with the quick reply program and later to efficient consumer response in the grocery industry (Lummus, 1999). Owing to strong competition in the textile and apparel industry world-wide, leaders in the US apparel industry formed the Crafted with Pride in the USA Council in 1984 (Kurt Salmon Associates, Inc., 1993). Kurt Salmon Associates, Inc conducted a study and the result of this study was the development of the quick response (QR) strategy. QR is a partnership where retailers and suppliers work together to respond more quickly to consumer needs by sharing information. Significant changes as a result of the study were the industry adoption of the UPC code used by the grocery industry and a set of standards for electronic data interchange (EDI) between companies. Retailers began installing point of sale (POS) scanning systems to transfer sales information rapidly to distributors and manufacturers. QR incorporates marketing information on promotion, discounts, and forecasts into the manufacturing and distribution plan (Mullin, 1994).

Besides the apparel and grocery industry initiatives, other early manufacturing efforts to improve supply chain performance have been documented. Some of these include: Hewlett-Packard, Whirlpool, Wal-Mart and other world leading organisations. A short outline of their supply chain initiatives are described as follows (Lummus et al. 1999)

C. Whirlpool

Manufacturer of appliances began supply chain implementation with a team of executives in 1992. Whirlpool created a new vice-president of logistics position, established cross-functional teams for key product areas, entered into sole source agreements with suppliers based on reliability and the ability to assist in product design, and is using EDI to communicate daily with suppliers all as part of its supply chain management program. As a result, product accessibility is up in the 90-95 percent range, inventories have been reduced by 15 to 20 percent and lead times reduced to as low as five days.

D. Hewlett-Packard

According to Hammell et al (1993) Hewlett-Packard is a computer components manufacturer who systematically linked its distribution activities with its manufacturing activities in the computer terminal business in the early 1990s. The execution included changes in both the physical distribution of the product, and a fresh distribution requirements planning (DRP) system. The DRP system nets customer orders with forecasts and serves as the beginning pull in the supply chain.

E. Wal-Mart

By their own initiatives Wal-Mart began their own supply chain by working directly with key manufacturers (Johnson and Davis, 1995). The manufacturers are answerable for managing Wal-Mart's warehouse inventory of their products, termed vendor managed inventory (VMI). In return, Wal-Mart expects near 100 percent order fulfilment rates on those products. KMart and other large retailers have implemented similar VMI programs.

F. Supply Chain Management and the Petroleum Industry

The oil and gas industry comprises two parts: 'upstream' which is the exploration and production sector of the industry; and 'downstream' is the sector which deals with refining and processing of crude oil and gas products, their distribution and marketing. A typical oil industry supply chain includes exploration of new petroleum (crude oil) reservoirs, drilling of crude wells, crude extraction at onshore and offshore platforms, its transport to the refineries, the refining of the crude oil (raw material) in the refineries in order to produce the final products (petroleum derivatives), such as gasoline and diesel, the transport of those products to distribution terminals where they are dispatched to distribution companies, and finally the delivery of the derivatives to the final customers at places like a gas stations (Marcellino et al. 2009). Information sharing becomes a vital ingredient during the processes in both the upstream and downstream. The definition of supply chain management by Quinn (1997) clearly talks about the use of information systems that can be used to monitor the activities within the supply chain.

G. Information Systems and Supply Chain Management

A supply chain is defined as a network of suppliers, manufacturers, warehouses, distributors and retailers who through coordinated plans and activities build up products by changing raw materials to finished goods (Chandra and Grabis, 2007). The supply chain covers all organizations and activities associated with the flow and conversion of goods from raw materials to the end user and how information flows is associated with it. In a supply chain, material and information flow up and down the chain which in turn must be managed. The act of supply chain management involves a variety of approaches used to integrate suppliers, manufacturers and distributors in performing their duties: materials procurement, materials conversion in-between and finished products, the distribution of all these needed products to customers in the correct quantities, to the required locations and at the exact time to meet the required service level with least cost. Companies create high-performing value systems, providing member organizations an important competitive advantage through teamwork and information sharing (Handfield and Nichols, 2002). According to Quinn (2007) information systems are so necessary to monitor all of those information sharing activities within the supply chain.

H. Background of Information System

According to Cohen et al. (1998) the meaning of "information systems" has been growing in diversity and complexity. Information systems could not stay alive without information but yet still information has no clear definition (Mingers, 1997). Normally information has been defined as "interpreted data" and the same data might cause different interpretations as different persons might associate different meanings to the same data. An interpretation is by its

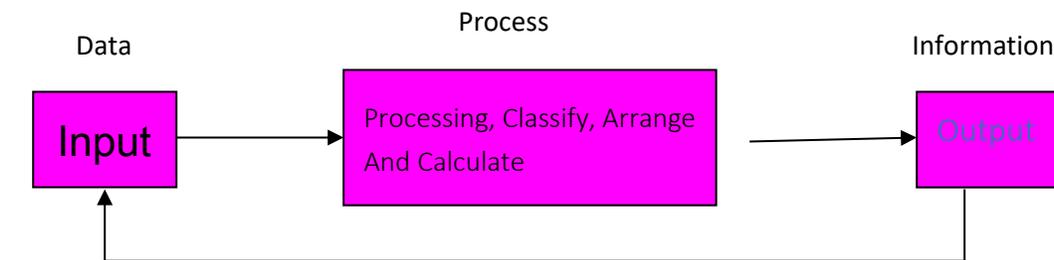
own nature subjective, which is related to a subject, a mind, ego, or agent of whatever sort that sustains or assumes the form of thought or consciousness. The information systems (IS) history only span five decades as by the mid-sixties information system was already eating its way into business mainstream. The use of computer in organizations usually started off in the accounting departments as it was assumed that this area would know the most about using numerical machines and the falling short of understanding in how important databases could be in other areas of the business. During the mid-eighties which was the time most manufacturing companies had started to shift to information system to forecast sales, take orders, and manage distribution of products. While computers stayed out of reach for most businesses, telecommunications made its mark with the telex machine. In 1932, the Telex Service was introduced in Great Britain for administrative use by the British post office. As reported by Kimberlin (1986), telex machine is a [character printer connected](#) to a [telegraph](#) that [operates](#) like a [typewriter](#). This step taken by businesses gave organizations the ability to communicate within and anywhere in the world at any time and effectively pass instructions and information. By this period a number of business school began developing Management Information System (MIS) programs to meet the growing need of IS managers. The World Wide Web was developed by Barnes-Lee in 1989 and the protocol HTML used over the existing Internets that had been constructed opened up a new age of EDI the world had never seen. In the mid-1990's it became apparent that there is no way for a corporation to competently do business without a solid functioning IS setup inside its own walls as well as connected with its supply-chain vendors and distributors. EDI as it was once known as Electronic Data Processing (EDP) have now brought profit margins so low that any business that does not prepare itself will be out of business in the next five years.

Information systems are technology driven system which currently without it, business would not be what it is today. It has seen developments over the past fifty years to being the back bone of business, yet the simple application rules created in the 1960s and 1970s are still very relevant in any application where data or information is transferred in whatever business model it is applied to no matter the intricacy. In a research by Huston University (2012) it was concluded that the commencement of information system has done more to enlarge business and industry into global markets than any other convention in history. Today the backbone of information system is now the World Wide Web, Internet, or with a business a Local Area Network, along with lists of acronym buzz word; EDI, EIS, ERP, SCM and host of others to describe new ways in which information system can be employed to grow business.

I. Information System Defined

According to the UK Academy for Information System, information systems are the means by which people and organisations utilising technologies gather, process, store, use and disseminate information. The encyclopaedia Britannica (2013) defines information system as an integrated set of components for collecting, storing, and processing data and for delivering [information](#), knowledge, and digital products. The Institute of Electrical and Electronics Engineering (IEEE) defined Information systems (IS) as sets of components that are organized in a way that supports the execution of some functions (IEEE 1990). According to Nickerson (2000) I.S does not limit the mechanisms to being only technical, that is computers and code but also sees that the people, the processes, and the information are also part of an information system. Information technology (IT) is defined as the equipments and methods used for involuntary information processing and transferring as well as the knowledge of using these equipments and methods (The Finnish Terminology Centre TSK, 1993). Wognum et al. (2004) shared a similar opinion about the fact that information systems drive is to support user organizations in their information needs. For examples, information systems investigated in this thesis are Enterprise Resource Planning (ERP) systems, Product Data Management (PDM) systems, Customer Relationship Management (CRM) systems, Supply Chain Management (SCM) systems, project follow-up systems, other document handling systems and other tools that impact the way of working in some part of an organization.

Figure 2.2 Data and Information



Source: Laudon and Laudon, (2004).

Feedback

J. Information Technology and Information Systems

Information technology and information systems are two closely related fields of study that people find very confusing to differentiate between (Olivia, 2011). Despite all the similarities there are differences that need to be highlighted. Information technology can be considered as a subset of information systems. It deals with the technology part of any information system, and as such deals with hardware, servers, operating systems and software. As clearly defined already information system is concerned with the information that computer systems can provide to aid a company, non-profit or governmental organization in defining and achieving its goals. It is also concerned with the processes that an enterprise can implement and improve using information technology.

III. IMPLEMENTING INFORMATION SYSTEM

Implementation of an information management system can be a traumatic experience due to the series of activities involved in doing so. OMCs in the Kumasi metropolis should understand that the installation of a new information system is a political process. It involves pressure, persuasion, and compromise in proper proportions as in the case with any important supporting action. It is imperative not to oversell the potential of the new information system. Most OMCs are not certain of the success of the implementation and so does not feel encouraged. Some of the indigenous OMCs have tagged information system as something for the multinationals and so they are skeptical of its usage. To facilitate a successful implementation, management at all levels within the organization must be convinced that the new system, in fact, is going to be used and that it will help them do a better job. Operating managers will be more likely to support the system if they are convinced that, on balance, it will benefit them in carrying out their assigned responsibilities. I will also recommend that managers teach managers, that is, top management should discuss the new system with subordinates, who then carry the message to their subordinates, and so on. Since the teachers must they become more fully indoctrinated?

A. Local Software Development

The researcher will recommend that software developers in Ghana try to develop softwares that some of these OMCs can adopt and easily use effectively for their operations. I can only hope that the price will be affordable and well-tailored for OMC operations. I believe this may be embraced since some of the OMCs are afraid of the cost of getting consultants to travel from a far place just to come and resolve system problems. All these serve as hindrances to the use of information systems mostly by these indigenous OMCs.

B. Software Development

The National Petroleum Authority (NPA) is a statutory agency regulating, overseeing and monitoring the petroleum downstream industry in Ghana to ensure efficiency, growth and stakeholder satisfaction (www.npa.gov.gh/npa_new). The NPA is being supported in its call by the Bulk Oil distribution companies as well as the Oil Marketing Companies (National Petroleum Authority Act, 2005 Act 691). During the research, the researcher observed that most of the mode of operations has been set out by the regulator. Some of the practices have been the same since the incorporation of the NPA and it will need some reforms. Some of these industry regulations are holding these OMCs back in adopting new methods to ensure that they are aligned with modern day OMC operations. Specifically operations at the Bulk Oil Distribution must always be done by representatives of the OMCs whereas with the integration of information system some of these human involvements and under dealings can be avoided. I will highly recommend that the regulator look at possible means to adopt more technological means in its regulation of the OMCs and the BDCs.

IV. FINDINGS

The purpose of this study was to examine the influential role of information system within the supply chain with major emphasis on OMCs in the Kumasi metropolis. The findings of the study can be summarized as follows: That 100% of sampled OMCs in this study have one time or the other used an information system. Among the respondents 75% agree to the fact that information systems are very influential in their operations and this finding can be linked to objective three of the study. This assertion was received from most of the multinational OMCs that were sampled.

In line with objective two of the study, 100% of the sampled OMCs believe that once technology is not static they will welcome the evolving of the information system used by their organizations once funds are there to purchase and ensure their successful implementation.

There was unanimous agreement amongst all respondents that they are in involvement with various suppliers in their operations. About 46% agree that the major means of placing orders from their suppliers was by phone as others used e-mails, EDIs, etc.

The issue of what information was captured by these information system was (70%) dominated by tracking information of requested supplies of petroleum products. Furthermore, in meeting objective one of the study, (68%) feel motivated by the use of information systems because it improves efficiency, saves time and helps to cut some operational cost.

V. CONCLUSION

The Petroleum sector is currently one sector in the Ghanaian economy which has gained a lot of media attention. The discovery of oil coupled with the numerous benefits it brings to the Ghanaian economy as well as its impact on the Ghanaian environment is perhaps some of the reasons for its attention.

This research has confirmed that the amount of information flow in OMC operations is heavily increasing and it is vitally important to efficiently manage and share information inside and among suppliers in the chain of the organizations operation. The invention and availability of information systems is to help ensure that organizations just like the OMCs found in the Kumasi metropolis or elsewhere make use of them to attain greater efficiency.

It is vital for OMCs, BDCs and the NPA to improve their support for each other to ensure that they all live up to their mandate and also grow positively. Information systems can have a great influence within the supply chain of any business when implemented and OMCs are better placed to adopt the recommendations of this study.

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