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ROLE OF ICT TOOLS IN SUPPLY CHAIN PERFORMANCE

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Abstract

Organizations today now require ICT tools that efficient and effective that will give them to access important and relevant information easily and on time so as to enable them to maintain a competitive edge. ICT has enabled interactions between different organizations along the supply chain thus, facilitating data sharing and exchange of information at higher speed and accuracy enabling organizations to meet customer demands on time thus meeting set customer service standards. The need to stay ahead of competition requires organizations to now embrace ICT advancement in their day to day operations. Efficient and effective material handling management can only be achieved with the cooperation of efficient and effective departments within supply chain. The selection of suppliers and negotiation of all aspects of contracts relating to inventory are activities in which purchasing professionals are expected to play a leading role. ERP, MRP, Bar-coding, RFID and DRP have been able to achieve this need and organizations should aspire to include these systems in their supply chain. When ICT tools are well implemented, the company will benefit from them and as a result, the organization will be able to save on costs and eventually make high profits. They will also be able to reduce or eliminate wastes; they will also reduce inventory holding thus releasing capital. Therefore, it is important that, information system researchers continue to research and produce new knowledge that moves the organizations towards current vision of "up to date ICT tools".

Keywords: *Supply chain, Information Communication Technology, Enterprise Resource Planning*

1.0 INTRODUCTION

1.1 Background

Information and communication technologies (ICT) are one of the most important enablers of effective supply chain management Jack et al (2006). A great deal of interest in supply chain management stems from the availability of information and the methods to analyze this information to reach meaningful results. As electronic business gain importance, new opportunities exist, and the wide spread use of internet is increasing the interest for the information technologies (Haag and Stephen, 2010). ICT tools are a source of competitive power for many companies. Especially for service industries such as big retailers, transportation companies such as DHL and airline companies where they are now using information technologies them widely as a result, information technologies have earned a vital role in many organizations (Lysons & Farrington, 2006). In supply chain management, time and opportunities to get information on time is very important. Accurate and timely information will enable the organization to increase service level and as a result decrease the costs and lead times (Bottani (2008). Along with this, many companies are offering information technologies based services to their customers in order to gain competitive edge and sustain long term relationships with them.

ICT tools provide a supportive role for human resource activities to improve organizational (or personal) efficiency and effectiveness (Cohen et al, 2002). Therefore, ICT tools helps to execute activities faster, support autonomous decision-making processes, and enable distributive operations (Huang and Nof, 1999) in order to achieve higher logistics efficiency (Jack et al, 2006). In away, the use of ICT tools makes the processes more transparent to the stakeholders, which in turn, could lead to adoption of better business practices to meet the customer service levels (Bharadwaj 2000). The desire of any organization is to have ICT tools facilitating the 4 production process, marketing, supply chain integration and customer feedback which help it to better outreach and eventually in reducing the business costs and reaps high costs. A supply chain covers all activities related to the flow and transformation of products from the raw materials point (extraction), through to the consumer as well as the related information flows (Effy and Jones 2008).

According to Fine (1998), in a usual supply chain, supplies are procured and items are produced at one or more factories, shipped to warehouses for transitional storage space and then forwarded to retailers or end users. Supply chains encompass the companies and the business activities needed to plan, create, transport, and use a goods or service. Businesses expect their supply chains to provide them with the necessary information so as to carry on and succeed. Inaccuracy problems in inventory management are important in supply chain management. Although many companies have automated their inventory management using ICT tools, inventory levels in information systems and the real physical inventory levels often do not match. The difference between these inventory levels is called inaccuracy and can deeply affect the performance of the firms.

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

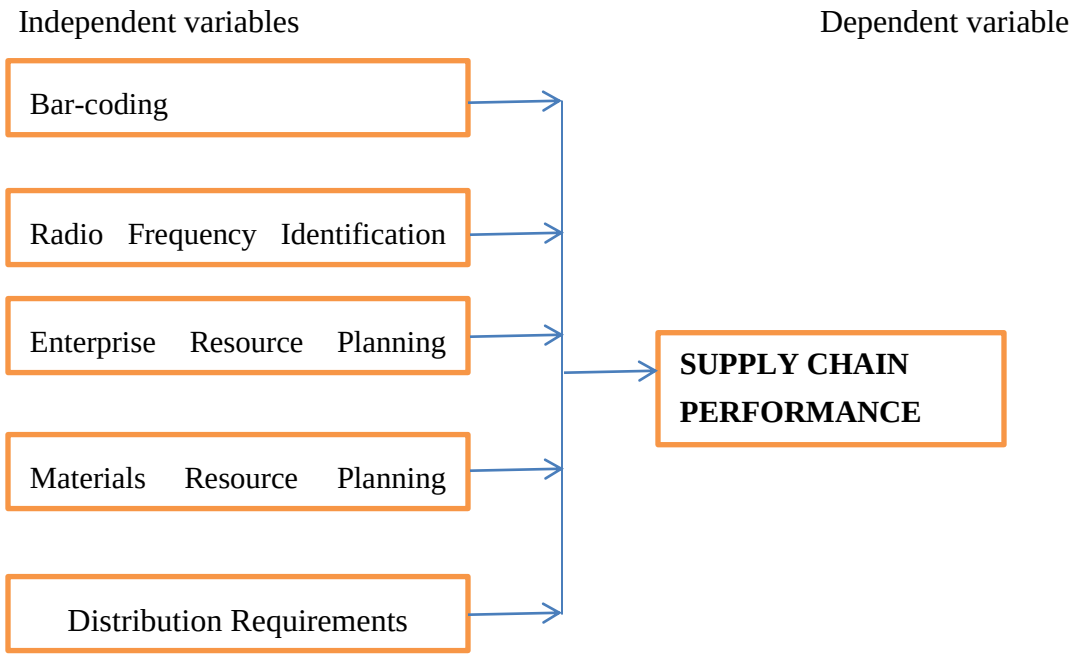

Figure 1: Conceptual framework

2.2 Conceptualization of Variables

2.2.1 Bar-Coding

Lysons and Farrington (2006) noted that a barcode is a readable representation of information by a computer. Originally, information on barcodes was stored in the widths and spacing of written parallel lines, but nowadays, they come in different patterns of dots, concentric circles, and text codes. Barcodes can be read by optical scanners called barcode readers or scanner. Barcodes are widely used to implement automatic data capture systems that improve the speed and accuracy of computer data entry. Bar-coding accelerates the flow of products and information throughout the business. Barcoding may be used in counting raw materials and finished goods inventories, automatic sorting of cartons and bins on conveyor belts and palletizers, production reporting, automatic warehouse applications, including receiving, put away picking and shipping, package tracking, access control and lot tracking (Lysons and Farrington 2006).

2.2.2 Radio Frequency Identification (RFID)

An RFID tag contains a silicon chip that carries an identification number and an antenna able to transmit the number to a reading device. This means improved inventory management and replenishment and replenishment practices, which in turn, result in a reduction of interrupted production or lost sales due to being out of stock (Lysons & Farrington (2006). RFID enables

bulk read where many tags can be read in a short space of time –a typical read rate is hundreds of tags per second, the tags can be read over a very long range – many hundreds of meters in the case of specialized tags. RFID tags are durable because they can be ripped, soiled and performance is not impaired. They can do bulk reading in a short space of time. All these importance enhance the performance of the supply chain (Gerald & David, 2000).

2.2.3 Enterprise Resource Planning (ERP)

ERP is a business management system that, supported by multi-module application software that incorporates all departments or functions of the organization. While MRP allows manufacturers to track supplies, work-in-progress and the output of finished goods to meet sales order, ERP is applicable to all organizations and allow managers from all functions or departments to have an understanding of what is or is not taking place throughout the organization (Lysons and Farrington, 2006). Most of ERP systems are designed around a number of modules, each of which can be standalone or combined with others. The modules in the ERP system are finance, marketing, procurement, manufacturing, supplier management and human resource among other modules.

According to Leenders & Fearon (1993) the finance module tracks financial information, such as accounts receivable and payable, payroll and other financial and management accounting information throughout the enterprise. The logistics module is often broken down further into sub-modules covering inventory and warehouse management and transportation. Lysons and Farrington (2006) notes that the manufacturing module tracks the flow of orders or product, including MRP and the progress and coordination of manufacturing the supplier management tracks the purchasing process, from requisitioning to the payment of suppliers and monitors delivery of suppliers and supplier performance. And, the human resource module covers many human resource management activities, including planning, training and job allocation.

ERP system plays a vital role in improving supply chain performance. There is faster inventory turnover because the manufacturers and distributors may increase inventory turns tenfold and reduce inventory costs by 10 to 40 per cent (Jack and Samuel (2006). There is improved customer service, in many cases, and ERP system can increase the production to a higher rate by providing the required products at the required place within the required time thus achieving customer expectation and satisfaction. ERP facilitates better inventory accuracy with fewer audits thus, reducing the need for physical audits. It also reduces the set-up time by ensuring coordination of people, tools and machinery together with efficient use of equipment and minimizing downtime by virtue of efficient maintenance. ERP software leads to high quality work with strong manufacturing components, proactively pinpoints quality issues, providing the information required to increase production levels reduce wastes or rework (Jack & Samuel (2006).

2.2.4 Material Resource planning (MRP)

This is a technique that assists in the detailed planning of production and its characteristics are that; it is geared specifically to assembly operations, it is a dependent demand technique and it is a computer based information system. The aim of MRP is to make available either purchased or company manufacturing assemblies just before they are required by the next stage of production

or for delivery. It enables orders to be tracked throughout the entire manufacturing process and assist purchasing and control departments to move the right supplies at the right time to manufacturing or distribution points (Lysons & Farrington, 2006).

MRP plays a vital role in supply chain by helping coordination efforts of production, engineering, purchasing, marketing and human resource to achieving a common strategy or business plan (Gerald & David, 2000). It also helps the supply chain managers to analyze implications of their decisions, the changes can easily be factored into the system as they arise, such as rush orders and coordination of production with purchasing, marketing and human resources in such away as timing of supplies deliveries, using sales forecast to determine master budget and planning recruitment or run-down of personnel.

2.2.5 Distribution Requirements Planning (DRP)

Distribution requirements planning (DRP) is scheduling technique the controls inventory control and applies MRP principles to distribution inventories It can also be considered as a method of handling replenishment of the stock in an organization. DRP is useful for both manufacturing organizations, such as car manufactures that sell their car via several distribution points, such as regional and local distributors, and purely merchandising organizations, such as supermarkets (William, 2009).

2.3 Relevance of ICT tools

Using ICT tools to manage distribution and supply chain increases efficiency and certainty and waste reduction in the value chain and have a great impacts on all market players. Large buyers in the supplier networks often use ICT tools to manage their producer networks. The ICT tools address record keeping, monitoring of field agents activities, operations of procurement, tasks of credit and payment, distribution of inputs, forecasting and determining productivity of the organization (Leenders &Fearon, 2006).

Most distribution networks such as input supply companies selling frequently use ICT tools to help manage their inventory in remote distribution networks. This application include systems that process see orders and in voice products electronically, control inventory and costs, communication with clients and identification with new markets (William 2009). RFID technologies offer several contributions to supply chain through their advanced properties such as unique identification of products, easiness of communication and real time information (Yazici, 2002). Thus RFID can improve the traceability of products and the visibility throughout the entire supply chain and also can make reliable and speed up tracking, shipping, checkout and counting processes, which lead to improved inventory flows and more accurate information (Helo et al, 2008). RFID leads to incremental revenue due to reduction in stock-out rates, incremental revenue due to improved visibility of stocks. In terms of cost of goods sold, RFID leads to reduced expired product write-offs, reduced product shrinkage, reduced labour costs in shipping, receiving, managing returns, reduced inventory carrying cost, reduced safety stock due to improved inventory accuracy and reduced lead time it also leads to reduced cycle stock due to improved visibility.

Reorganizing processes using this new technology can also lead to large gains in the overall supply chain effectiveness (Helo et al, 2008). Bottanni and Rizzi (1993) conclude that, reengineering models highlight possible benefits gained through RFID for all processes of distribution centers and retailers. Anti theft car key inside the casing of the car key is an RFID chip when you insert the key into the ignition, the RFID chip must communicate with the reader in your ignition system (and pass the

password) for the car to start (Haag and Cummings 2010). So, it does not good for the criminal to have a copy of your car key.
Supply chain – almost every major participant in the supply chain process is now mandating that other participant tag merchandize, trays and merchandize boxes and skids of merchandize and so own with RFID chips (Haag & Cummings 2010).

Functionally, an ERP system primarily supports the management and administration of the deployment of resources within a single (though possibly multi-site) organization. These resources can be materials, capacities, human labor, capital, etc. ERP systems current contribute to this by providing various types functionality, (Huang & Nof 1999). An engine for transaction processing which allows for the integrated data management throughout the organization; Work flow management functions controlling the numerous process flows that exist in the enterprise, such as the order-to-cash process or the purchasing processes; and Decision making support functions, assisting in the making of policies for example, by doing an MRP run, and processing specific orders of the customer (e.g. by performing an Available-to-Promise (ATP) check).

The companies increase their competitive power and service quality by enabling their customers or clients to access services offered from anywhere and at any time. The companies can also track the customer preferences and demands on electronic environment. MRP has many benefits both for production and assembly operations. Some of these benefits are listed here: low levels of in-process stocks, a possibility to track the component needs, a possibility to evaluate the capacity requirements suggested by the main schedule, a possibility of distributing the production time. Jack and Samuel (2006), the conditions required to successfully and efficiently utilize and use the MRP system are: computers and software should maintain the records and execute the calculations; computers should be accurate and updated together with integrity of the information (main schedules, bill of material, inventory records).

2.4 Empirical Review

2.4.1 Barcodes

According to Helo et al. (2008), Barcode have being in used since 1970s for the identification of products in the service sectors. It is a code made from narrow related lines and spaces which can be stored in 20 to 30 characters per inch of coded information known as Universal Product Code (UPC). Gerald et al 2000, Bar-coding contributes to the performance of supply chain by facilitating faster data entry. Barcode scanners can record data five to seven times as fast as a skilled typist. Barcodes facilitates greater accuracy where an entry error rate is about 1 in 3 million, it reduces labour costs as a result of time saved and increased productivity, it helps in elimination of costly over or under stocking and the increased efficiency of JIT inventory systems. Bar-coding helps in better decision making by capturing information that would be difficult to collect in other ways, which help supply chain managers to make fully informed decisions. It also facilitates faster access to information and greater responsiveness to customers and suppliers.

2.4.2 Radio Frequency Identification (RFID)

Lysons and Farrington (2006), advised that RFID is a generic term for technologies that use radio wave to automatically identify individual items. RFID is a technology that allows data transfer between tags and readers without the necessity of line of light over a distance of up to a couple of 10 meters depending on the type of tag used. For RFID system, the information is being transferred via radio wave, and multiple tags can be read or written simultaneously.

The first use of radio wave to transmit the signals as similar to the RFID technology can date back to World War II when transponder (tags) were put on airplane and used to identify an approaching plane. Interrogators (readers) sent a signal to the transponder on the plane and the signal that is sent back could be used to distinguish between friendly and hostile aircraft (William, 2009). According to Effy and Andy (2010), RFID technologies may improve the expected results of supply chain management by ensuring that inventory is kept at its minimal level and as a result, increases efficiency and effectiveness of the processes to as to get accurate information. Different RFID systems can be gotten by putting together various labels, readers, correct frequencies and level of labeling.

2.4.3 Enterprise Resource Planning (ERP)

Given that suppliers are located all over the world, it is important to incorporate various activities of the organization within and outside. (Yazici, 2002). To achieve this, a wide enterprise information system is needed for information sharing on a range of value adding activities along the supply chain (Yazici, 2002).

According to Helo et al, (2008), ERP is a business management system made up from a collection of applications or modules that integrates company functions such as marketing, finance, manufacturing and logistics. ERP uses database technology to control and integrate information related to a company's business including data related to customers, suppliers, employees and finance. Ideally, all business transactions, such as inventory management, consumer order management, production planning and distribution are entered, recorded, processed, monitored and reported.

According to William (2009), ERP is a system that incorporates all information required by the operating functions effectively together with finance, marketing, procurement, accounting, human resources, production, material handling, value addition, maintenance of quality, allocation and distribution of raw materials and finished products by process reengineering and information technology. ERP will incorporate supply chain management (SCM) to provide the organization with more accurate and reliable information (Lysons and Farrington 2006).

According to William (2009) ERP systems can be instrumental in transforming functionally oriented organizations into process oriented ones. The very nature of the ERP system forces one to think process-wise, rather than department-wise. Indeed, some of the unexpected benefits of ERP implementations may well stem from improved communication between different departments across business processes. Haag and Cummings (2010) claimed that we still know little about the use of ERP systems in the supply chain. Huge amounts of money are spent in purchasing, implementing, running and updating such systems whereas these aspects are hardly researched at all. In 2003, Helo et al. found that ERP systems would only have a modest role, if any, in improving supply chain performance. One reason would be that ERP systems were developed to integrate the functions within one firm rather than to integrate with multiple partners. Still, a similar conclusion was made

by Bharadwaj (2000), who claimed that ERP systems provide tools that can support and obstruct supply chain integration in the same time. William (2009) pointed out both the hard issues (technology, information and measurement systems) and the soft issues (culture, trust and willingness to collaborate) as barriers for supply chain management.

2.4.4 Material Resource Planning (MRP)

MRP is a computer-based system designed to organize the timing and ordering of the dependent demand products. The demand for the raw material and components of the final product are calculated by using the demand for the final product and it is determined how much and in what quantity to order from these components and raw material, considering the production and lead times and counting back from the delivery time of the product. Thus, the demand for the final product is used to calculate the demand for the components in lower levels. This process is divided into planning periods and the production and assembly functions are organized, resulting in lower inventory levels along with ensuring the timely deliveries of the final product
Lysons and Farrington (2006), Ordering and timing processes were facing two difficulties in the past. The first one was the difficulty of production scheduling, dealing with the changes in the orders, and tracing many parts and components supplied by many suppliers. Due to this complexity, several policies have been proposed in the literature. Lysons and Farrington (2006) provide an overview of multiple-supplier models. The second difficulty was the lack of distinction between the dependent and independent demand. The techniques designed for the independent demand was being used for the dependent demand as well, resulting in high levels of inventories. Effy and Andy (2008), MRP starts with a schedule for the final product, and this schedule is transformed into another schedule ensuring the timely delivery of the components and raw material required in the production of the final product. The inputs for the MRP system is a bill of material, a main schedule showing when and how much of the final product is needed, and an inventory records file showing how much inventory is at hand or how much is ordered. The planner determines the requirements for each planning period, using these inputs.

According to Effy and Andy (2008), MRP is based on future need, calculated by MRP software from demand forecasts. MRP programs take customer demand as their initial input. The main input of MRP programs is the number of product units needed and the time at which they are needed; the programs then work back to calculate the amounts of resource required to produce subparts and assemblies. The programs use long range forecasts to put long-lead material on order.

3.0 SUMMARY AND CONCLUSIONS

Information is an important driver to any organization that serves as the element that creates and results to a coordinated effective supply chain. Therefore, it must be current, accurate, validated, and accessible in a timely and suitable manner, focused to the scope and intelligently managed by analytics. ICT tools support supply chain activities, proper planning and management strategic decisions by a holistic visibility on; inventory (demands patterns, carrying costs), transportation (customer location, shipment sizes), facility (location, capacity, smart grid), and use design for recycle and reuse, limit waste and defects. An ICT tool (ERP, CRM) also allows enhances the performance of the entire supply chain to make it less troublesome (Lysons and Farrington 2006).

Organizations must be sensitive of the ever changing business environment that dictates the competitive environment they operate in. Staying ahead of the competition ensures an organizations survival and lagging behind may lead to its demise. Embracing of Information Communication Technology (ICT) ensures that the supply chain balances its need to satisfy customer needs and also to manage costs so as to attain profits.

ICT tools offer a good strategy within an organization to achieve strategic goals of customer satisfaction and profitability through cost management. Of late, ICT tools have been used to ensure efficient and effective performance of supply chain. Technological advancements that include DRP, ERP, MRP, Barcodes and RFID have enabled organizations to achieve competitive edge in material management and more organizations are now embracing the technological advancements.

ICT tools contribute to smooth operations of supply chain. Companies that do not embrace ICT tools in their supply chain suffer problems of workload, long lead time, responsiveness, consistence in quality and efficiency. ICT tools contribution to supply chain performance has been recognized by all organizations especially in manufacturing. It has become easier for these firms to have proper and accurate well-kept records for inventory and raw materials, the distribution and transport channels are well coordinated.

4.0 RECOMMENDATIONS

Given that ICT tools can have revolutionary impact on supply chain performance researchers need to adopt a more forward looking stance in relation to ICT tools. Viewing ICT tools as an incremental improvement of supply chain performance can turn out to be the best thing to all organizations that are involved in logistics and manufacturing. Future research needs to continue the development of sound theoretical models and instruments. There is an urgent need for understanding the costs and benefits of ERP, the implementation challenges, and the management of the system once it is installed and up running.

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