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# Managing Logistics Information System: Theoretical Underpinning

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**Abstract:** The research sought to explain the theoretical background of articulating effective logistics information system in any industrial outfit. This is predicated on the fact that logistics is "the process of strategically managing the acquisition, movement and storage of materials, parts and finished inventory (and the related information flows) through the organisation and its marketing channel in such a way that current and future profitability is maximized through the cost-effective fulfillment of orders. However, the theoretical basis of the information has not been fully understood within the context of logistics system, such that it will give a pointer to how those inherent costs could be managed or saved, as well as enhanced supplier-customer collaborative relationships. It is in the light of this that the paper attempt to give theoretical considerations, through descriptive methodology approach, on how those basic objectives of logistics can be achieved and its ultimate goal can be realized. The study concluded that emphasis should be placed on attributes of logistics information systems and particularly information cost in order to enhance logistics efficiency and effectiveness.

**Key words:** Cost, information, logistics, managing, system, theoretical

## INTRODUCTION

Definition of systems is significant to definition of information. For instance "information is that intellectual that in a certain domain can be acquired, preserved, transferred and applied as non-empty sets of information elements, such that each element determines a certain aspect entity". (Long, 2003). Hence, the definition of an information system should then bed a system that can manage knowledge. Lambert, (2004), defines it: "An information system is a system for collection, adaptation, storage, transfer and presentation of information in an, for the users of the information system, effective way. The information system can be totally or party computerized."

Logistics is "the process of strategically managing the acquisition, movement and storage of materials, parts and finished inventory (and the related information flows) through the organisation and its marketing channel in such a way that current and future profitability is maximized through the cost-effective fulfillment of orders (Somuyiwa, 2010; Somuyiwa and Sangosanya, 2007; Christopher, 1992; CLM, 1998). Logistics adds value by making products available in the right place and at the right time. If a product for instance is available at the place it is needed, logistics is said to have added place utility, if it is delivered at the right time, logistics has added time utility. Then the aim of logistics can be phrased in terms of getting the highest customer utility or perceived value. In essence, it is trying to maximise the difference between perceived value and actual costs.

The concept of logistics is ancient. There is nothing new about the components of the field of logistics. There have been warehousing goods since the days of ancient Egyptian grenaliers. Things have been moving by transport since people first learnt that logs float downstream. Moreover, storage has been in existence since people first discovered that, that was a way to survive long and cold winter. What is new is how it is done (Glaskowsky, 1970; Waidringer and Eng, 2001), and which is perhaps synonymous to logistics management.

In the same token, electronic commerce and associated business-to-business transaction capabilities have changed the way in which supply chain operates. The Internet has for instance, enabled information exchange on an unprecedented scale, often at a pace too fast for normal consumption. Hence, companies are now equipped to make effective use of data, from warehouse management systems, which contain information on supplier/customer warehouse inventory levels and key customer ordering patterns and transportation management systems within which information pertaining to the location of important supply chain assets, such as products or vehicles is typically stored. The integration of these systems leads to global inventory visibility which, in turn, leads to reduced costs and improved customer services by decreasing shipping and receiving cycle times, increasing shipment and inventory accuracy, and decreasing lead time variably that all have impacts on logistics cost (Moberg, 2002; Somuyiwa, 2010). However, the theoretical basis of the information has not

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been fully understood within the context of logistics system, such that it will give a pointer to those inherent cost could be managed or saved, as well as enhanced supplier-customer collaborative relationships. It is in the light of this that the study attempts to give theoretical considerations on how those basic objectives of logistics can be achieved and its ultimate goal can be realized.

## RESULTS AND DISCUSSION

The paper is theoretical in nature; hence methodology approach will be specifically descriptive, such that the philosophical presupposition of the concepts that was adopted to some selected manufacturing companies in South-Western Nigeria between 2007 and 2010, can be understood.

**Information and communication technology in logistics:** ICT's comprises a number of technologies, which may, but need not be internet-based. In a setting of logistics. Bowersox *et al.* (2002) distinguish between transaction systems, operational planning systems, and control systems. These may be computer mediated (extranets, intranets) or based on Internet or web technology:

**Transaction system:** Electronic Data Interchange (EDI, the electronic transfer of structure data by agreed message standards from one computer application, with a minimum of human intervention, connecting all parties in a supply chain), interactive telephone systems, and e-commerce, e.g. Business-to-Business (B2B) e-marketplaces, for the global procurement of inputs; contracting of logistic services, directly by the shipper or by a so-called third-party logistic service provider (3Pls); or Business-to-Consumer (B2C) on-line sales to consumers.

**Operational planning system:** All sorts of logistic decision support and route planning software, e.g. Advanced Planning and Scheduling (APS), enabling the design, planning and operation of supply chain, including performance measurement for all participants in the chain; Enterprises Resources Planning (ERP) systems, enabling the processing, recording and fulfillment of orders, e.g. in warehouses or stores; and route planning software designed to avoid congested roads based on digital maps and real-time traffic information.

**Control system:** mobile communication (phones), tracking-and-tracing systems (Barcode-scanning for packages and palettes), tracking vehicles with Global Positioning System (GPS), measuring vehicle performance with 'black boxes' (containing logistic data), and Automatic Equipment Identification (AEI).

A coherent analysis of the impact of ICTs in the logistic industry should thus deal with control and planning (e-fleet management) as well as transaction (e-commerce and e-logistics) systems, whether these are internet or web-based or not. However, we may focus on internet and web-based system, for the practical reason of data and literature availability, because EDI is a relatively expensive-often excluding small firms (E-Business Watch, 2002) and closed system, thus losing ground to the open standard of relatively cheap internet technology, and mostly because e-commerce (for worldwide procurement and/or sales) is so closely related with e-logistics (the use of the internet for contracting logistic functions) and e-fleet management (the use of the internet for managing logistic functions), If we take into account the various forms of Intelligent Transport Systems (ITS)- a term commonly used to refer to the application of ICT to enhance the efficiency of the existing of the exiting road infrastructure (Smith *et al.*, 2001).

**Logistics and information flow:** The stream of data in different directions with variable contents between various databases (departments) within a company is defined as information flow. According to Stair and Reynolds (2001), data for a logistics management information system can come from many sources. At the same time, Lambert and Stock (2001) define the most important sources of data for the common database, which are the order processing system, company records, industry data, and management data as revealed in Fig. 1.

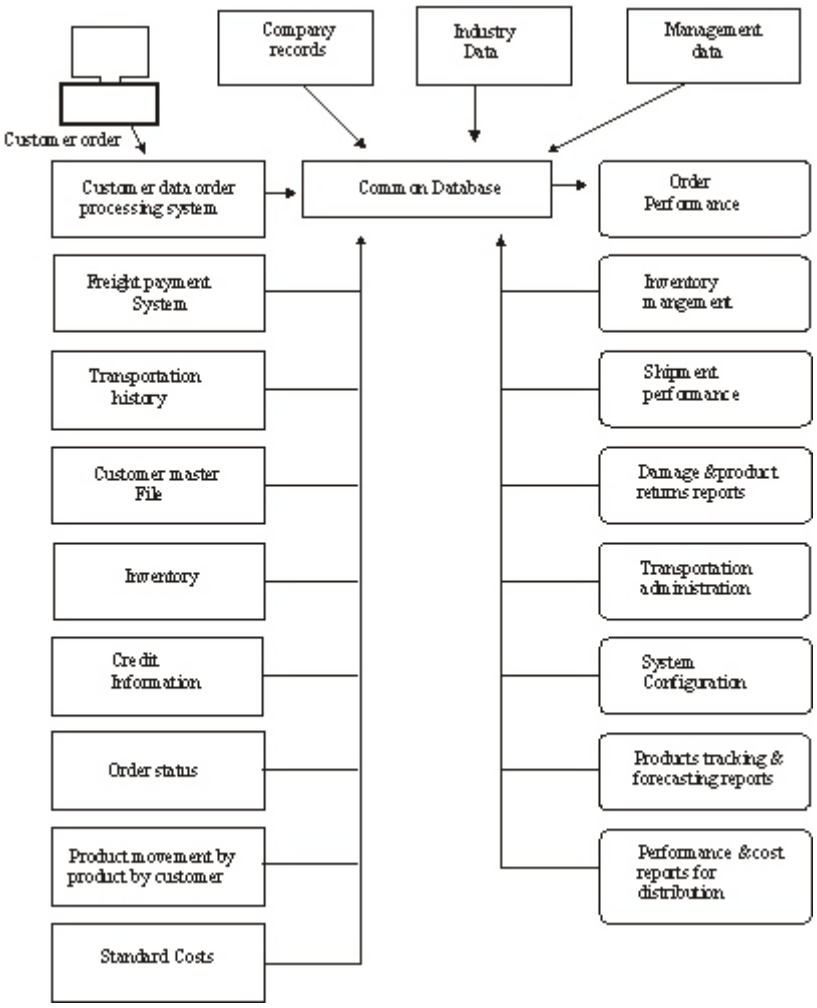
Similarly, Moberg *et al.* (2002) further defined operational and strategic information as almost the same as Bowersox *et al.* (2002) characterization of logistics information utilisation in two major logistics processes:

**Planning/coordination:** the overall purpose of planning/coordination is to identify required operational information and to facilitate supply chain integration via strategic objectives, capacity constraints, logistics requirements, inventory deployment, manufacturing requirements, procurement requirements, and forecasting.

**Operations:** accurate and timely information to facilitate logistics operations. Operational information is required in six related areas: order processing, order assignment, distribution operations, inventory management, transportation and shipping, and procurement.

As a result, Bowersox *et al.* (2002) name four reasons why timely and accurate information has become more critical for effective logistics systems' design and operations:

- Customers perceive information about order status, product availability, delivery schedule, shipment tracking, and invoices as necessary elements of total customer service.




Source: Lambert and Stock, (2001)

Fig. 1: The logistics information flow

- With the goal of reducing total supply chain assets, managers realize that in formation can be used to reduce inventory and human resource requirements.
- Information increases flexibility with regard to how, when, and where resources may be utilized to gain strategic advantage.
- Enhanced information transfer and exchange capability utilizing the internet is changing between buyers and sellers and redefining the channel relationships.

**Uses of information technology in the supply chain:** IT in supply chain has enabled the gathering, storing, and analysis of unprecedented amounts of data. It equally facilitates planning at all levels through data analysis and sharing, which enable planning to occur at the strategic, tactical, and operational levels. Similarly, IT gathers, integrates, and analyzes logistical data to streamline local and global supply chain. Every trading partner in the supply chain must be working from the same data shared in real time through a common hub. Sequentially passing information across each link of the supply chain perpetuates duplication of data, missed information, and time delays.

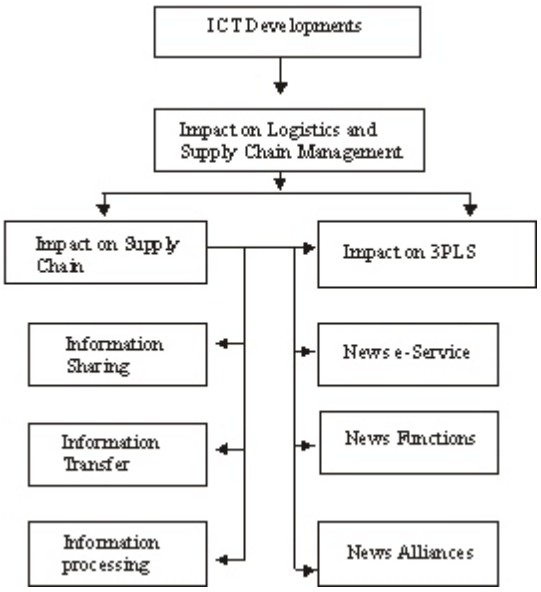
In a related development, IT orchestrates the flow of demand supply, and cash in supply chain networks, with equal information flow material flow plus cash flow that include:

- Information flows replace or delay inventory flows whenever possible.
- Logistics and cost information aspects of each physical materials flow are performed electronically for better reliability and velocity, lower cost, and higher levels customer service.
- Electronic cash flows such as secure Electronic Fund Transfer (EFT) free up cash faster for reinvestment.

Table 1: ICT and application for logistics

| Function | Activity | ICT Technology |
|---|---|---|
| Sharing of data and information | Access and use of data and information by supply chain partners | -Databases<br>-Datawarehouse |
| Information transfer | Communication of Information between supply chain partner | -EDI<br>-E-Mail<br>-Groupware<br>-Inernet/WEB |
| Information use for supply chain planning | Data and e-document processing in decision making and operations planning of the supply chain | -Advanced AI<br>-CAD<br>-CAE<br>-ERP<br>-MRP<br>-Multimedia<br>-Traditional AI |

Source: Adapted from Collins (2005) and Somuyiwa (2010)




Source: Adapted from Carlson (2005) and Collins (2005)

Fig. 2: Framework for analyzing the impact of ICT on logistics and SCM

The faster information flows along the supply chain, the faster operational decisions can be made. The faster material and cash flow along the supply chain, the faster a company's money is freed from the manufacturing or procurement cycle.

One of the main areas of interest that has emerged in recent years concerns the effects of ICT on logistics. In the literature, there are a plethora of research that have analysed general aspects (Long, 2003; Lambert, 2004) and specific effects (Lovorn, 2003; ASCET, 2004) of these technologies in logistics, considering the wide range of possible effects, the attention in this chapter is focused on the supply chain efficiency improvements related to ICT usage be analysed with reference to three functions related to information/Order processing and management, Distribution and sharing of Data and information , their transfer and lastly, the processing and utilization of information for supply chain specific technologies used as a support tool for the three functions identified and summarized in Fig. 2 and Table 1.

**Information sharing:** is an essential prerequisite for securing information accessibility to all supply chain partners involved in logistics operations. The creation of distributed databases accelerates the development of relationships with other operators in the Supply Chain. In addition, the availability of consistent information improves decision-making process for operators. Data sharing has always been important in the transport and logistics of manufacturing companies. Access to and availability of information in intermodal transport, for instance, contribute to substantially reduced processes and thus time savings in freight transfer from one mode of transport to another and minimize errors in drawing up freight documentation, thereby increasing overall transport efficiency.

**Information transfer:** is probably the most relevant function in the SCM concept, because it takes place through several technologies ranging from the most recent e-business applications or extranet, Electronic Data Interchange (EDI) systems, to the most traditional communication technologies such as telephone, telex or fax. EDI is the most investigated technology in SCM literature. The widespread dissemination of the internet and e-business technologies allow to a large extent overcoming problems relating to systems and applications interoperability.This allows to extend the use of these technologies, including EDI, to smaller companies since internet application technologies require relatively low implementation costs and show a high flexibility in information transfer.

In supply chain operation planning, ICT also plays a major role to the extent that the benefits obtained from the application of SCM logic depend almost entirely on a company's capability to establish electronic links with customers, suppliers and third party logistics 3pls. ICT

investments made by companies can range from platforms capable of satisfying the needs of single firms, such as Enterprise Resource Planning (ERP), to new applications that integrate all the stages of the supply chain and are able to support the entire planning process as the Enterprise Integration Application (EIA), or the Advanced Planning System (APS). Through these new systems, companies are able to combine and align their planning with that of other supply chain partners by covering the whole area of supply chain stage and thus making the planning process more efficient.

In the light of all these, the dissemination of ICT has opened up new opportunities for the development of new roles and functions in the supply chain, the so called informediaries or on-line freight, e-market places. The purpose of these web-based intermediaries is to give added value to transport and logistics business through greater efficiency and information transparency.

**Enterprises resources planning:** Enterprises Resources Planning (ERP) is the English term for a business system. Again, another term that is used for business system is Enterprises System (ES). To described and ES in a simple way one could say that ES is an information system that manages all the resources available in a company. It is a common term for a co-operating software that manages and co-ordinates much of a company's resources, assets and activities (Boyle, 2004). Gartner Group developed the ERP concept under the 90's. The term ERP is defined by them as: "ERP is a planning and communication system that affects all the resources of a company."

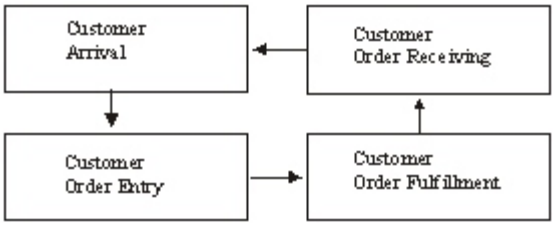
Boyle (2004) define it as: "not a system, but a framework that includes administrative (finance, accounting), human resources (payroll, benefits), and Manufacturing Resources Planning (MRP) (procurement production planning). ERP units major business processes - order processing general ledger, payroll, and production- within a single family of software modules."

There can be numerous benefits using enterprises systems and according to Davenport (2002.) the most significant are:

- Cycle time reduction
- Faster information transactions
- Better financial management
- Laying the groundwork for electronic commerce
- Making tacit process knowledge explicit (transferring knowledge from an aging workforce into the ES).

But there are not just benefits with enterprises; there are also both technical and business perspectives that are negative:

- Inflexibility. One of the greatest difficulties in any ES project is to match the system to the preferred ways of accomplishing a business process or activity. It is just too difficult to fit an ES to a business-both for the first time and for subsequent changes.




Source: Adapted from Somuyiwa (2010)

Fig. 3: Relationship among various stages of customers

- Long implementation periods. 3 to 5 year project duration is fairly common for implementing an ES in large company, and for companies in the rapidly changing business world these projects are insupportable.
- Overly hierarchical organizations. A third criticism of ES's is that they impose a hierarchical, "command and control: perspective on organizations.
- Antiquated technology. A final criticism of ES's is that most are based on obsolete technology; that is, that they are thinly disguised mainframe programme ported into the client/server world.

**Customer order cycle:** The customer order cycle: occurs at the customer/retailer interface and includes all process directly involved in receiving and filling the customer's order. Typically, the customer initiates this cycle at a retailer site, and the cycle primarily involves filling customer demand. The retailer's interaction with the customer starts when the customer arrives or contact is initiated and ends when the customer receives the order.

The processes involved in the customer order cycle are shown in Fig. 3 and include the following:

- Customer arrival
- Customer order entry
- Customer order fulfillment
- Customer order receiving
- Customer arrival: The term customer arrival refers to the customer's arrival at the location where he or she has access to his or her choices and makes a decision regarding a purchase. The starting point for any supply chain is the arrival of a customer.

Customer arrival can occur when

- the customer walks into a supermarket to make a purchase,
- the customer calls a mail order telemarketing center, or
- the customer uses the Web or an electronic link to mail order firm.

From the supply chain perspective, a key goal is to facilitate the contact between the customer and the appropriate product so that the customer's arrival turns

into a customer order. At a supermarket, facilitating a customer order may involve managing customer flows and product displays. At a telemarketing center, it may mean ensuring that customers do not have to wait on hold for too long. It may also mean having systems in place so that sales representatives can answer customer queries in a way that turns call into orders. At a Web site, a key system may be search capabilities with tools such as personalization that allow customers to quickly locate and view products that may interest them. The objective of the customer arrival process is to maximize the conversion of customer arrivals to customer order

**Customer order entry:** The term customer order entry refers to customers telling the retailer what products they want to purchase and the retailer allocating products to customers. At a supermarket, order entry may take the form of customers loading all items that they intend to purchase onto their carts. At a mail order firm's telemarketing center or Web site, order entry will involve customers informing the retailer of the items and quantities they selected.

The retailer then allocates the product to the customer order and may also provide a delivery date to the customer. The objective of the customer order entry process is to ensure that the order entry is quick and accurate and is communicated to all other supply chain processes that are affected by it.

**Customer order fulfillment:** During the customer order fulfillment process, the customer's order is filled and sent to the customer. At a supermarket, the customer performs this process. At a mail order firm this process generally includes picking the order from inventory, packaging it, and shipping it to the customer. All inventories will need to be updated, which may result in the initiation of the replenishment cycle.

In general, customer order fulfillment takes place directly from the manufacturer's production line. The objective of the customer order fulfillment process is to get the correct and complete orders to customers by the promised due dates and at the lowest possible cost.

**Customer order receiving:** During the customer order receiving process, the customer receives the order and takes ownership. Records of this receipt may be updated and cash payment initiated. At a supermarket, receiving occurs at the checkout counter. For a mail order firm, receiving occurs when the product is delivered to the customer.

**Extent of the use of IT devices in order processing and information cost:** This refers to how companies have made products and services available to customers. It also involves how various types of information technology devices are made available in each of the studied companies. The identified technologies are computer systems, electronic data transfer, electronic data interchange, magnetic ink character reader, local area network, wide area network and Electronic Resource Planning. Similarly, on the cost side, tangible, direct costs are straightforward, but there are some intangible and indirect costs that can be overlooked. The tangible costs include the direct costs of the IT product and ongoing service and maintenance, plus estimates for consulting fees, staff training and change management, staff and resources assigned to the project, and opportunity costs. However, many estimates mean many places for poor budgets. Many IT projects come in significantly over budget because managers:

- Overlook major cost items such as operational support cost
- Use estimates that assume everything will go according to plan
- Purposely underestimate costs to secure project approval.

The three basic categories of costs are capital expenditures, one-time project expenses, and ongoing support activities. Capital expenditures are amortized over the expected life of the technology. If this amortization period exceeds the actual product life, the costs will be underestimated. One-time project fees often contain hidden costs such as fees to investigate alternative systems, training travel and lodging, data conversion and normalization, or lost productivity time when employees go through a learning curve. Ongoing support costs include annual license fees and maintenance fees for vendor support costs include upgrades, taxes on fixed assets, and IT support staff. Analytical software may have additional cost such as the cost of generating mathematical or simulation models once software is installed.

It is perhaps not advisable to underestimate the cost of reallocation employees to an IT project. Just because a salaries employee is a sunk cost does not mean that this cost should be ignored in the justification. Employees should be used when the savings from long-term maintenance using experienced staff are greater that the savings of using an already seasoned consultant. A final cost to consider is the cost of not implementing the project.

## CONCLUSION

The relative importance of information cost in the total logistics cost has been identified and discussed with a view to examining the efficiency and effectiveness of associated information sharing cost in downstream

logistics, as well as to determine the rate at which information and technology investment is influenced by order processing. It is obvious, that the trend is becoming new among manufacturing companies in Nigeria. Closely akin to this is the fact that training and maintenance cost are two major areas in which information cost is incurred. This is as a result of alien attribute of these information devices, consequently, personnel need to be trained and devices need to be maintained.

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