

Impact of Technology on Logistics and Supply Chain Management

Rajiv Bhandari

F-303, Arenja Complex, Sector 8, C.B.D Belapur Navi Mumbai 400614, 9819884293
Email – rajiv_sies@yahoo.co.in

Abstract:- The word logistics has its origin from Greek word “logistike” which means the art of calculating. However, the modern interpretation of the term logistics has its origin in the military, where it was used to describe the activities related to the procurement of ammunitions, and essential supplies for troops located at the front. Logistics not only includes activities related to the physical movements of the goods but also manages relationship with suppliers and customers. However Logistic management is a means whereby the needs of customers are satisfied through integration and coordination of the supply chain. The main objective of the paper is to determine the various technology used in logistics and supply chain management including **information technology, communication technology and automatic identification technology**. The paper also discusses the impact of the technology on logistics and supply chain management. The author mainly focuses on the secondary data for collecting data relating to various technology used in logistics and supply chain management. The author draws conclusion that Technology is a vehicle to enhance supply chain competitiveness and performance by enhancing the overall effectiveness and efficiency of logistics system. Moreover various innovations in technology have made the task easier and faster besides being less laborious.

I. INTRODUCTION

The council of logistic management defines logistics as “that part of supply chain process that plans, implements, and controls the efficient, effective, forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer requirement”. In ordinary language the same can be defined as right product, at the right place, in right time, and in right condition. However supply chain consists of all stages that are required to satisfy the customer request. It starts from supplier passes through manufacturer, distribution, retailer and finally reaches the customer. The supply chain management is the oversight of materials, information and finances as they move in the process from supplier to manufacturer to wholesaler to retailer to customer.

The emerging new technologies are creating strategic opportunities for the organizations to build competitive advantages in various functional areas of management including logistics and supply chain management. However the degree of success depends on the selection of the right technology for the application, availability of proper organizational infrastructure, culture and management policies. In logistics, information, communication and automation technologies has substantially increased speed of identification, data gathering, processing, analysis and transmission, with high level of accuracy and reliability. Technology is a means to enhance business competitiveness and performance. It plays a major role in success of supply chain by enhancing the overall effectiveness and efficiency of the logistics system. In logistics many new technologies are used in developed country while in India adoption process is very slow. However due to liberalization of the Indian economy the competitive pressure is building up and the only option to face the competition in to go in for technology enabled operations.

The latest technologies being used in logistics and supply chain management are segregated into

- Automatic Identification Technology
- Communication Technology
- Information Technology

II. OBJECTIVES

- To determine the various technology used in logistics and supply chain management.
- To discusses the impact of technology on logistics and supply chain management.

Automatic Identification Technology

Automatic Identification (Auto ID) is the term used to describe the direct entry of data or information in the computer system, programmable logic controllers or any microprocessor-controlled device without operating a keyboard. These technologies include Bar Coding, Radio Frequency Identification (RFID) and Voice Recognition. Auto ID can be used for tracking the containers, packages, cartons or a truck carrying the goods on time bound dispatches to the customers. The benefits of Auto ID include accuracy, cost saving, speed and convenience of data storage and processing of information.

The significant Automatic Identification technologies in use are –

- **Bar coding** – Bar coding is a sequence of parallel lines of different thickness with spaces in between. These bars are nothing but the items of information in the codified form, which can be read with the help of a scanner. Historically bar codes was first used in a supermarkets in USA in 1952. The information printed in bar code include, country code, manufacturer name, product details, date of manufacture, material content etc. These details are required at user end for inventory management. The bar codes are used in diverse industries such as retail, pharmaceutical, consumer goods, electronics, automobiles etc.

The bar coding offers the following advantages.

- Ease in identification of inventory items during storage, retrieval, pickup, inspection and dispatch.
- Reduce paper work and processing time leading
- Reduce human error
- Increases logistics system productivity through speed, accuracy and reliability.

Impact of Bar code technology on operations of logistics and supply chain management

- **Procurement operation** – The parts and components brought from suppliers are assigned bar codes, which contain information on item name, batch number, date of manufacture, order no, serial no etc. The information in bar code helps in identifying and tracking the component. In the warehouse, when the goods enter through a conveyor, they are further scanned by the hand held scanner or scanner fixed alongside the conveyor. The information decoded by the scanner is immediately logged in the central computer which helps real time update of inventory records.
- **Processing** – During the order processing the bar code will help in keeping identification of items based on their date of entry into the warehouse or store. This will ease material storage, retrieval and dispatch in FIFO (First in First out) inventory management system.
- **Production operation** – During the production process the identification of in-process and finished items become easier due to bar coding. The various batches at different stages of production can be easily tracked.
- **Distribution operation** – During distribution, barcode helps in identifying and tracking the transit of finished goods to the customers.

BARCODE



- **Radio Frequency Identification (RFID)** – RFID is an Automatic Identification and Data Capture (AIDC) technology. RFID first appeared in tracking and access applications during 1980. RFID-based systems allows for non contact reading and are effective in manufacturing and other hostile environment where bar codes could not survive. These are used as an alternative to Barcodes to communicate the inventory data to the reader via radio waves. RFID wirelessly exchanges information between a tagged object and a reader.

An RFID system is compromised of the following components as mentioned below.

- One or more tags called Radio Frequency Tags (RFTs), which includes a semiconductor chip and antenna.
- One or more read/write devices also called readers.
- Two or more antennas one on the tag and one on the reader.
- Application software and the host computer system.



RFTs

The reader is connected to the central computer. Radio Frequency Tags (RFTs) are a piece of silicon chip to store data in the microcircuit. The RFTs are programmable with erasable memory. Data is stored in coded form and communicated to the reader through waves. The basic principle of tag is that antenna emits the radio signals. RFTs are very useful to accompany truck shipments. The tag will contain information on consignor, consignee, inventory items, quantity and value, what time the item travelled certain zone; even the temperature etc. The reader receives the tag signal with its antenna, decodes it and transfers the data to the host computer system. RFTs can be attached to virtually anything—from a semi tractor, to a pallet, containers etc. RFTs will avoid paperwork and can be helpful in quick clearance at octroi and custom posts. In the warehouse, the barcodes can be applied to the individual inventory items while RFTs can be applied to pallets, containers etc. These will allow the staff to directly communicate to the warehouse computer.

RFID has significant impact on logistics and supply chain of many sectors

- ❖ RFID helps Indian exporters to global retailers like WAL-MART get better and more visibility into movement of their goods within the supply chain and thus become more competitive.
- ❖ Improve the ability of manufacturers to better manage the inventory levels.
- ❖ Improve the complex distribution system for the Defense operation.
- ❖ Improve the complex tracking and distribution operations of the Indian Postal services.
- ❖ Improve the tracking, logistics and planning operations of Indian Railways, state public transport agencies
- ❖ Implement automatic toll collection on vast network of highways.

Case study of RFID Technology

- ✓ **Procter & Gamble(P&G) Company**
Before – P&G used bar codes to track shipments of goods from factory to retail outlets, but couldn't do much to halt the supply shortages on store shelves.
After – P&G used RFID is tracking shipments, and eventually individual products, so that they can be stocked on demand in stores. P&G expects to cut its costs by \$400 million a year.
- ✓ **Ford Motor Company**
Before – Assembly-line workers running low on parts would have to pick up a phone and call the replenishment department to get more parts and then wait for parts.
After – Ford puts RFID tags on each parts bin. Warehouse operators now know in seconds, when supplies run low, and automatically deliver parts as needed to workers on the assembly line.
- **Voice Interactive System** – This technology was developed in 1980. It is used in the field like medical, manufacturing, warehousing etc. In warehouse application; it allows the worker or operator to communicate the data to central computer without using the keyboard. It keeps the warehouse workers hands free to pickup, pack and inspect the goods. He can read the part /item number while driving the forklift or picking the inventory and move from one pallet to other pallet. Due to online data transmission to central computer there will be real time data updating.

III. COMMUNICATION TECHNOLOGY

The communication, either oral or written has a very crucial role in business success. The following are the few emerging communications technologies, which are enablers to superior customer service leading to competitiveness through the speed and accuracy in communication.

- **Electronic Data Interchange (EDI)** - EDI technology is used for transfer of business documents from one computer to other computer. With EDI the business documents such as invoices, cheques, and challans are sent electronically from one organization to another. In fact EDI is a drive towards paperless document transfer or transactions. The difference between the email message and EDI message is that, E-mail is composed and interpreted manually, while EDI message is composed using one software and interpreted by other software. E-mail data is not structured while EDI data or message is structured. EDI message has legal standing in the court of law.

The benefits of using EDI technology in logistics and supply chain management involves

- ✓ Faster transactions- real time document transfer in the supply chain.
 - ✓ Just-in-Time manufacturing technique can be adopted.
 - ✓ Reduction in transaction cost due to paperless operations
 - ✓ Reduction in order cycle time and inventory that will help to improve the competitiveness of the customers.
 - ✓ Improve the corporate trading relationships between parties in the supply chain and creating barriers for competitors.
- **Very Small Aperture Terminal (VSAT)** - The satellite communication channels are playing a crucial role in real time data collection and its exchange, which is vital for customer service. To trace and track the goods carrier, a dish antenna is fixed on the vehicle. This allows the communication between driver, consignor and consignee. The real – time interaction helps in having the up-to-date information on the location of truck and the delivery position.

Example. – Wal-Mart the retail giant of USA is using this system for controlling the inventory movement.

- **Geographical positioning System (GPS)** – The GPS is more accurate system used in developed countries wherein a vehicle could be traced accurately with the help of Geo Stationary Satellites to the accuracy of one meter in terms of latitude and longitude. Once the position of the vehicle is known, it can be transmitted to consigner or consignee through the transmission network i.e. mobile phones or internet.
- **Geographical Information System (GIS)** – GIS are the software tools for visualization of special location of any entity on earth which is stored in databases relating to geography .This could be in terms of physical maps of the surface of earth, layout of inner surface of earth or a layout of streets or roads. GIS in integration with GPS is used in logistical operation for tracking and tracing of the consignment location to the extent of road or street in particular city.
- **Web Based Tracking** –Logistics service providers operating in India are extending the services of web-based tracking of consignments to their clients. AFL, Fed-Ex, Blue Dart and others are providing the status report of the consignment to their clients. The clients can download this report by connecting through the Internet. This information helps in planning the dispatch schedule and also making follow up with clients for payment collections.
- **Automated Guided Vehicle System (AGVS)** - The system makes use of magnetic or optical guidance system. The magnetic system uses energized wire laid on the warehouse floor for guiding the material handling equipment. In AGVS operator is eliminated. The new generation AVGS are guided with video and do not follow the fixed path. AGVS can perform all the material handling operation without any human involvement. Robot coupled with AGVS is used to pick up exact material requirement for a customer order.
- **Information Directed System (IDS)** - In this a centralized computer controls the material handling equipment. The communication between the equipment and the computer is through radio frequency. The required movement are fed into computer and it assigns the jobs to the individual equipments considering its maximum loading capacity and handling speed. IDS can perform variety of complex material handling jobs such as multiple order picking or multiple vehicle loading by the same material handling equipment leading to enhancement in warehouse productivity and flexibility in handling variety of jobs.



Information Technology (IT) –

IT consists of hardware and software that captures, analyses and provide information wherever it is needed. Since the supply chain management is defined as network of organizations, these organizations cannot form a network unless they are connected through IT resulting into transparency in the supply chain and aligning the supply chain activities towards customer.

Example – The success of supply chain of DELL was due to IT, where internet was used to collect order from customer directly and shared the information with the suppliers so that they can forecast better, and supply to the requirement.

The IT tools used in logistics and supply chain management are-

- **Enterprise Resource Planning (ERP)** - ERP is integrated software, encompassing all the business operations and bring about significant change in the way people work. ERP is a business solution that addresses to certain identified business issues. ERP is very expensive and complex exercise which require sufficient amount of planning. In India major ERP in use is SAP, Oracle which has been developed by foreign companies to suit the business environment prevailing in those countries. However, some Indian companies like Ramco Systems developed ERP to suit Indian business environment.

ERP helps in optimization of supply chain management and develop competitiveness by ensuring the following advantages

- Quicker response to customer requirement.
- Reduction in inventory costs.
- Improvement in service levels- internal and external.
- Improvement in inventory turnover rate
- Reduction in logistics cost.

Example - The companies like Hindustan Lever, Colgate and Nestle have implemented ERP in their supply chain system resulting in minimum inventory of raw material and finished goods and benefit in terms of cost reduction

- **Distribution Requirement planning(DRP)**- It is another IT tool and also a sophisticated planning approach that takes into consideration multiple distribution stages and the characteristics of the distribution system. The finished goods inventory requirement is determined by DRP considering the customer demand at multiple distribution centers located in different markets.DRP helps in consolidating the shipments to multiple locations spread over the vast geographical area, and thus help in reducing freight cost. DRP improves inventory visibility in the supply chain resulting into reduction in inventory level and warehouse space requirement.
- **Automated Inventory tracking system (AITS)** - The AITS is an IT tool that gives real time status of the inventory levels of all the items at retail stores, feeder and mother warehouses. For replenishment of items sold, information is conveyed directly to the supplier after the item inventory level is checked at feeder and mother warehouses. The supplier initiates the action to replenish the inventory item depending on the item take-off rate at retail stores, its safety stock, inventory in transit etc thereby optimizing the inventory in the supply chain.

Example – Wal-Mart, a leading US retail chain giant controlling the inventory investments throughout the supply chain with the help of AITS.

Impact of IT on functions of logistics and supply chain management are as follows

- ❖ **Procurement**- In the initial period the procurement process in the organization was done by a separate department on the basis of least price from the supplier. In the next generation with the advent of IT the

e-procurement is done where online auctions are conducted and strategic relations are forged with good suppliers by long term contracts and relationships.

- ❖ **Planning** –In the initial period before the advent of IT, production and distribution planning was done based on historical data. There was not much linkage with business planning and production changed with varying demand. However with the advent of IT planning approach include **collaborative planning, forecasting and replenishment(CPRF)**. It involves long term commitment to information sharing for collaborative planning purposes like joint business planning(SKUs, brands) and financial planning.(sales, inventory, safety stock, pricing, fill rate).
- ❖ **Web-based collaboration**- The web-based collaboration application enables to share and collaborate with supply chain partners on forecasts, replenishment and promotions plans to deliver the highest level of customer service and profitability.
- ❖ **Scheduling** –In the initial period the scheduling was done to improve asset utilization and reduce manufacturing costs. However with the advent of IT strong linkage is established between supply chain partners and customers. As such scheduling is done to serve the customer at the right time.
- ❖ **Inventory management** –In the initial period every department tried to minimize the inventory by transferring it to the next level of the supply chain. Thus the total inventory cost in the supply chain was high as there was no transparency of the inventory held in the supply chain. However with the advent of IT, techniques such as **collaborative replenishment and vendor managed inventory** were followed where manufacturer takes the responsibility to replenish the distributor inventory, resulting in inventory control and access to demand information.
- ❖ **Logistics and warehouse management** – In the initial period logistics was more manual intensive and there was no visibility of the movement of goods. However due to the advent of IT and technologies like RFID and GPS complete visibility in movement of goods is assured resulting into efficient logistic and warehouse management.
- ❖ **Customer service** –In the initial period customer service was only **reactive**. The complaints or information was difficult to reach the concerned department and was time consuming process. However with the advent of IT, customer service is more **proactive** as it reaches the customer through internet and takes continuous feedback from them.

IV. CONCLUSION

“Technology” is vehicle to enhance supply chain competitiveness and performance by enhancing the overall effectiveness and efficiency of logistics system. Hence choosing the right technology for various logistics activities or sub-processes is very crucial to any business to gain competitive advantage in today’s competitive market.

Example – A cycle manufacturer must see how it can integrate the smallest component provider- namely, a brake shoe supplier and also the dealer at the rural center, in order to optimize production run and retain the customer instead of losing to the competitor. Today integration in the supply chain is possible due to available technology leading to efficiency in the supply chain only if the supply chain partners adopt the right strategy.

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