

Logistics and Supply Chain Management with EDP Systems and Operation Research Techniques a Feasibility Study

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Abstract—In modern days all the managements - even small or large scale bound to take day to day decisions for performing the Logistics and SCM, on basis of how much to produce and where to manufacture, and how to produce for whom the products are required, how much cost prices to be fixed, and how many numbers of the spares and products to be kept in stock are the key issues. No doubt, modern trends assisted with computer system with software could be made available for performing the above duties in a better way. By employing Optimization and Operations Research Techniques, is concerned with analytical and mathematical models to make the best decisions among alternatives. A study based on the past developments in modeling relating to Logistics and Supply Chain Management is delivered to understand the concept and end use of SCM. Various doubt and queries are discussed are under which circumstances under whose views are the things are obtained, how they are appropriate, and some final conclusions that follow from the models are made available and used to carry out the latest developments with the assistance of software / Electronic Product Codes Identification and computer based operations which are essential to made easier, quicker and accurate operations of the manufacturing and retail outlets for carrying out the Logistics and Supply Chain Management with operation research techniques.

Keywords—Logistics, Supply Chain, Optimization, Operation Research (OR) Techniques, System Based

INTRODUCTION

This study paper is focused on how the Indian industry especially small and medium scale firms having the hurdles in the manual operations of controlling the inventory and Supply Chain Activities. A little effort being applied to overcome the difficulties faced by them and suggested to go for automated / self relied software assisted inventory management system with the use of computers and modern Operation Research Technologies. To go for complete ERP and SAP are not viable due to their high cost and higher operating and technology know how personnel for whom we have to pay in lakhs of Rupees per head per month where as the companies are struggling to pay in five to ten thousands per head per month. To overcome this low cost inventory management with the transportations or logistics with Supply chain management with existing computer systems could be tried and the same is explained as following:

Logistics is the scientific management of the flow of resources between the point of origin and the point of destination in order to meet some requirements. The resources managed in logistics can include physical items such as raw materials, heavy equipment, perishable goods like food, liquids, and working staff as well as abstract items such as necessary IT information, moving particles, and energy. The transportation of physical items usually involves the integration of the flow of information, basic raw material movement or handling, manufacturing or production, final product packaging, in process inventory, carrying or transferring goods, storing or warehousing, and quite frequently the security. The complications of transport / logistics could be converted to model, analysed, visualised, and optimized by dedicated simulation software. Supply chain management (SCM) is the management of a network of interconnected businesses involved in the provision of product and service packages required by the end customers in a supply chain. The SCM spans all movement and storage of ore / raw materials and goods in-process inventory, and finished goods from point of origin to point of consumption. [Frank Straube, Shihua Ma, Michael Bohn (2008). Internationalisation of Logistics Systems, Springer. Peter Klaus (2009). "Logistics research: a 50 years' march of ideas," Logistics Research, Published Online, January 14.] In the latest trend of the industrial operations starting from raw material to finished goods all the materials are subjected to process say machining or processing in case of textile manufacturing. Irrespective of the field all the materials are taken for cost calculations to arrive the final product (output cost + profit) Price. The era of SCM studies was highlighted with the development of Electronic Data Interchange (EDI) systems in the 1960s and developed through the 1990s by the introduction of Enterprise Resource Planning (ERP) systems. This era has continued to develop into the 21st century with the expansion of internet-based collaborative systems.

This century of Supply Chain Evolution is characterised by both increasing value-adding and cost reductions through integration. Given the services performed by logisticians, the main fields of the transportation could be broken down as follows:

- Procurement Logistics
- Production Logistics
- Distribution Logistics
- After sales Logistics
- Disposal Logistics
- Reverse Logistics

Procurement Logistics consists of activities such as researching markets, planning the requirements, deciding to make or procure, original products producers management, order placement, and order controlling. The aimed quantity in the purchase or procurement transportations might be contradictory - maximize the efficiency by concentrating on core competences, outsourcing while maintaining the autonomy of the firm or concern, and minimisation of the purchase or the procurement costs while maximising the safety and the security within the supply process.

Production Logistics connects procurement to distribution transportations. The main function of production shop floor movements is to use the available production capacities to produce the products needed in distribution movements. Production moving of material activities are related to concepts of organisation, planning of layout, the production planning and control.

Distribution Transportation /Logistics has, the real important tasks, the delivery of the finished products to the end user or customer. This consists of the order processing, storing, warehousing, and transferring of goods. Distribution movement is necessary because the time, place, and quantity of production will vary with respect to time, location or place, and the quantity of consumption.

Disposal Movements / Logistics main function is to reduce transportation cost(s), to upward revise / enhance service(s), related to the delivering or deporting of unwanted waste produced during the operation of a business.

Reverse transportation or returning of goods movements stands for all operations related to the reuse of products and materials. The reverse transportation process includes the management and the sale of surplus as well as returned items of products.

OR (Operation Research) with Supply chain optimisation is the application of processes and tools to ensure the optimal operation of a manufacturing and distribution supply chains. This includes the optimal placement of inventory within the supply chain, minimizing operating costs (including Production costs, goods carrying costs, and the physical distribution costs). This regularly and every time involves the application of mathematical modelling and OR techniques like horseman problem, assignment of

storages and queuing theory FIFO (First in First Out / JIT Just in Time and Kanban (Two Bin System) Systems using simple computer software. Referred from Waldner, Jean-Baptiste (September, 1992). Principles of Computer-Integrated Manufacturing [1]. London: John Wiley & Sons. pp. 128-p132. ISBN 047193450X.

PROBLEM STATEMENT

Now a days the conventional transaction with monotonous and high volume of writing and record keeping of all the inventories viz., Raw Material, Purchase parts, Work in process parts, sub assemblies and main assemblies. Whether it is small or medium scale the above work are common and kardex like storing mechanism with Bin card operations are followed in the store keeping inclusive of stock issues and verifications which involved with more tiresome operation by stores / production /manufacturing personnel.

Purely manpower oriented and less skill of computer is used for record maintenance.

It could be involved with and explained as following:

- A) More voluminous and Excessive use of more conventional documents, leads to more errors and hence increased costs
- B) With frequent and more manual interventions to resolve problems in the process
- C) Various data exchange systems are not inter related
- D) Various proprietary systems with under estimated / ill-defined interfaces
- E) Noncompliance to national and international standards
- F) Faulty interpretation of data content and various operation processes across organisations
- G) Inability to immediate respond if any disruptions in the flow of goods during operations
- H) Leads to delay in the process and hence affect the schedule and dispatch of deliveries
- I) A close watch with each and every spares will be a tedious job for the progress control team
- J) Well assured delivery in time is not assured due to communication error and delayed manufacturing / production

The above defects / less efficient works could be studied thoroughly and a fruitful solution may be tried and recommended to arrive the desired goal to enhance the profit and productivity. The product requirement from the marketing is converted to product demand by the higher authorities and based on this preliminary and fore most Primary estimation with budget allocation is done. Based on the MRP (Material Requirement Plan) obtained from the design and development department all the components for manufacturing are listed out categorically by the Production Planning and control personnel.

The above data are discussed among the team of experts with various domain / filed experiences and based on their criticality we have to adapt the following methodologies:

- How much is our requirement? Like Minimum order placing quantity and lead time to be considered.
- When it is to be positioned? like JIT, FIFO / FILO to be followed
- By whom it is to be procured? By Buyer or by seniors or by Purchase Manager
- From it is to be procured ? Reputed dealer / Sub contract manufacturer or new development etc.,
- When it is to be arrived? Date on which the consignment is expected – Just in Time
- What would be condition of the supply whether is semi finished or fully finished?
- What will be its shelf life for example rubber life is 6 to 8 months? Time bound supplies.
- How precise it is and where to store the same for example high cost bearings etc.,

PROBLEM SOLUTION

Managing the inventory as detailed below:

- Daily material transaction is entered in computerised inventory and capacity management system developed existing EDP Electronic Data Processing Department personnel / software team.
- The database highlights the material which falls below the minimum level.
- The stores person looks for such entries in the database and decides on whether the purchase is to be made
- The database further suggests the reorder quantity.
- The stores person, after deciding on the purchases to be made and the quantities,
- He enters them in a table of database, which may be called the indent table.
- The purchasing manager has access to this table and He checks it the next morning and makes purchases accordingly.

The proposed system work is similar to software development like ERP. The process works as follows.

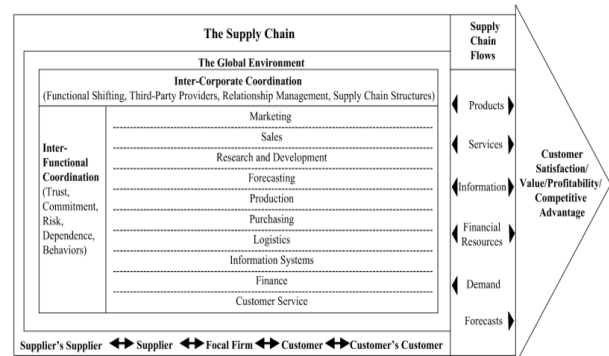
Each consumer tracking by the materials and transferred to a centralised server located inside the company;

- (i) System & implementation aspects
 - (a) Service-oriented design
 - (b) Adoption of a 3-tier architecture viz., database, application, WEB
 - (c) Application of EJB (Enterprise Java Beans) based on J2EE and Internet (Rich Client)
 - (e) Employing a reliable service and fault-tolerant configuration
- (ii) Work process aspects
 - (a) Unification of electronic document elements (tag).
 - (b) Removal of manual processing in check-in and check-out.
 - (c) Assurance of data correctness through various checks for events and documents.
- (iii) Application service provider aspects
 - (a) Composition of database engine, template engine, communication interface, database system.
 - (b) Database engine: Stores the parsed value into a database,

extracts data from the database system and sends that data to the template engine.

(c) Template engine: Transforms the received data from the database engine to a standard message format.

(d) Communication Interface: Communicates with other messaging systems



Source : Mentzer et al (2001a)

FIGURE 1 - A MODEL OF SUPPLY CHAIN MANAGEMENT

EVALUATION PHASE

The objectives of this phase were to quantify various attributes related to a process before and after the redesign. The activities of a process could have many attributes. Basically, a process is analysed in its full detail by partitioning it into value-adding and non-value-adding activities. By elimination of the non-value-adding activities, the process is redesigned. After simplification, Information Technology is used to further expedite the activities. Here, Information Technology means support from computerisation, communication and making few processes automatic which are routine. Especially, it was felt that active usage of Auto CAD needed to be made. The combined result of these efforts would enable a simplified process to be in its place. This is redefined and reflected in the output, e.g. reduction in lead time, reduction in inventory and better customer service. The objectives in this implementation phase were based on the redesigned processes and to carry out the implementation. The control points were defined in terms of inventory level, lead time, and simplification efforts in man days, etc. The critical processes entailed the following changes in the present SCM system. These changes are required in the current procedures, information flow and the computerised database. We list and analyse the effect of some of these changes for a sample process of designing the machine. The following are some of the suggested changes. . Customer representatives are to be included in the designing team. This would reduce the communication time between the design department and the customer, regarding the approval of the design and the changes required. The customer representatives would be authorized by the customer company to approve the drawings.

Invoice has to be done away with. The invoice is sent by the vendor to the accounts section. This carries the details about the material dispatched. The account tallies this against the purchase order, and goods inspection report (GIR) and inspection report. But this regularly and more frequently results in mismatch between at least two of these. If indent has not been sent with the material, then the accounts would have to tally only the GIR and inspection report against PO. Most of the inspection is to be done at the vendor's premises. If the quality of the material which arrives at the company is found to be non-conforming, it is sent back. This consumes time. So, if the material is inspected at the vendor's premises, either by the vendor or company's inspectors, this backtracking of material could be avoided. This is possible through a lean and dedicated vendor base.

Harmonic relations with vendors. The vendor would accept the above policy only if the relations between the company and the vendor are harmonic. He would allow the entry of company inspectors into his premises only if he has good and long term business with the company. This would also motivate him to improve the quality and service of his supply. All this would require that the number of suppliers to deal with is reduced. Less suppliers means that the chances of a particular supplier getting an order is more, i.e. there would be more frequent business with this supplier. In fact, we would suggest that the company should have only one supplier for each item. But, if the company management is pessimistic about the risk involved, then two vendors could be listed per item.

Proper vendor rating should be used. Having long term commitment with a vendor may make him reluctant. So, a formal performance measurement program is required which would monitor the performance of each vendor. The rating would keep track of the performance, the quality of material supplied and the service of the vendor. In addition, this could be used for selecting one of these listed vendors for giving the purchase order.

CONCLUSION

Development of the proposed integration technology will significantly impact the logistics industry in terms of quantitative and qualitative measures.

- First, the proposed integration technology will increase visibility between the departments.
- Second, it will decrease both the average and variance of transport times drastically.
- Third, it will reduce the cost of expedited and freight, and improve data accuracy and integrity.
- Just in time (JIT) and Kanban system could be added together to get the
- optimized quantity of the supply with pre determined lead time with optimized Economic Ordering Quantity.

The successful implementation of the proposed technology will have a great impact on several business areas. First, systems management services for logistics and SCM can be extended to logistics business services to increase shipment visibility and reduce transport time and variance according to profit-making models. The developed technologies and their implementation could be embedded into existing ERP and SC solutions for Large scale Industries also. The configurability of the development system makes it easy to develop a fruitful and accurate solution.

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