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## IT ENABLED SUPPLY CHAIN MANAGEMENT

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### Abstract

*The paper highlights the importance of Information Technology (IT) in Supply Chain Management. The main objectives of the paper are to study the various tools of IT, which helps to make optimum decision at every stage of a supply chain. The whole Supply Chain has been divided into five modules, namely, source, make, store, distribute, and market. The research is exploratory in nature exploring each module and how IT tools helps in making each module efficient and effective and finally integrating them to get the best possible result. The paper is concluded by presenting a case study of Diesel Locomotive Works, Varanasi, a premier institution manufacturing diesel locomotives for both national and international customers. The case study shows how IT has helped DLW to manage its Supply Chain in reducing its costs, having better relationship with both its suppliers/vendors and customers, and give better product and services to its customers.*

**Keywords:** Supply chain, IT, Diesel Locomotive Works

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### 1. INTRODUCTION

In today's fast moving and complex business environment, an efficient and effective Supply Chain is a must. In physical terms this translates into procuring the right raw materials, whether they are men, machines or materials, to produce goods and services, which are made available to the customers at the right time and at the right cost. Information Technology is one of the

essential tools to achieve this objective. Recent developments in Information Technology have transformed the way organizations conduct business. Today, companies are slashing costs using real time electronic communications, improving customer intimacy by leveraging the Internet, and taking advantage of new business models. Hence it is very essential to learn to identify, access, and communicate the strategic competitive advantage enabled

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by Information Technology.

During the last three decades, supply chain management has been both an important and a productive aim of corporations. By working to coordinate the production, shipment, and delivery of the goods required to meet their business needs, companies have been able to more easily meet the demands of their customers. However as the 21st century unfolds, supply chain management is evolving into what many experts refer to as synchronized supply chains. With synchronized supply chains, the overall goal is the same as with traditional supply chain management. There are three key differences, however. One is that companies work with their vendors in order to coordinate their processes and to achieve simultaneous production. Another difference is that the Internet and other types of technology are incorporated into the process to make those processes run smoother and more efficiently. Finally, the buying organization will need to hire, train, and restructure their workforce in order to be able to accommodate this type of supply chain management. Even though most companies do realize that better supply chain management can benefit their bottom line, too many of them are leery about pursuing modernization and efficiency fully. However, the value exists for companies who wish to make the changes necessary to achieve it. Some companies that have pursued supply chain modernization and upgrades have been able to lower costs and boost profits by tens or hundreds of millions of dollars. One way to achieve this increased value is the compression strategy. Compression allows the processes between the buyers and vendors to be streamlined. There are a number of ways this can be accomplished, and the businesses involved

must do their research to determine which are most effective for their needs. Two of the possibilities are: allowing assemblers to be responsible for maintaining the inventory so distributors only focus on making sales, and the second is eliminating the distributor channel altogether so that the assembler would be responsible for putting together the product and for making the sales. In addition to compression strategies, there are other steps to securing productive Supply Chain Management (SCM). First, the business must determine the strategy it wishes to use as the SCM's guiding force. Once the company determines this, the company needs to decide which supply chain configuration will work best for it. There is a wide array of possible configurations available, so the company must again do its research. Following those decisions, the companies must also begin to forge supplier relationships. Because the supply chain is only as strong as those relationships that bind the vendors, buyers, and other participants together, this step is crucial. Viewing these other companies and suppliers as partners in the success of the supply chain is important and should be a top priority within the buying organization. Once all of these components are in place, the business needs to take the next step and choose the proper technology architecture to make the supply chain work well. Some large businesses opt for the full implementation of an ERP system, which can effectively automate and coordinate many of the supply chain elements. The Internet is an important productivity tool that should also be incorporated fully into the supply chain because it streamlines many of the processes involved in procurement.

Effective supply chain management using information technology solves many of the

problems encountered by businesses today. First, the vendors involved in the chain will actually have a clearer idea of what the buyer needs and can then adequately provide for these needs. Slow response times and delays in project start dates also become less frequent because the automated supply chain helps shave the time off of the order placement and fulfillment process. Furthermore, IT-enabled supply chains generally result in lower costs for all parties involved because when secure relationships are established and when the supply and demand for products is in alignment, the total prices paid by organizations are generally much lower. This gives the competitive advantage which the organizations are looking for and triggers fierce competition among the organizations, which ultimately will benefit the customers in lowering cost and improving quality.

### 1.1. An Overview

Information Technology (IT) helps in integrating all the different activities of the Supply Chain. Information is crucial to the performance of a Supply Chain as it provides the basis upon which supply chain managers make decisions. Hence, the tools of IT help to gain awareness of information, analyze this information, and act on it to improve the performance of the Supply Chain. The co-ordinated activities of Supply Chain are Procurement (source), Manufacturing (make), Logistics (move), Warehousing (store), and Market (sell). Within each of these processes, there are short term and long term decisions.

At its core Supply Chain Management (SCM) is based on optimizing the performance of the system as a whole. Organizational research has demonstrated

that every factory and distribution center used by a large manufacturer can be operating at peak efficiency, and the organization as whole can still be operating sub optimally. It is analogous to a sports team where the individual players who have great statistics but the team cannot win. The need of the hour is not to work in water tight compartments where every department works efficiently but in isolation but to have semi-permeable membrane between the departments which gives it shape and lets the information flow.

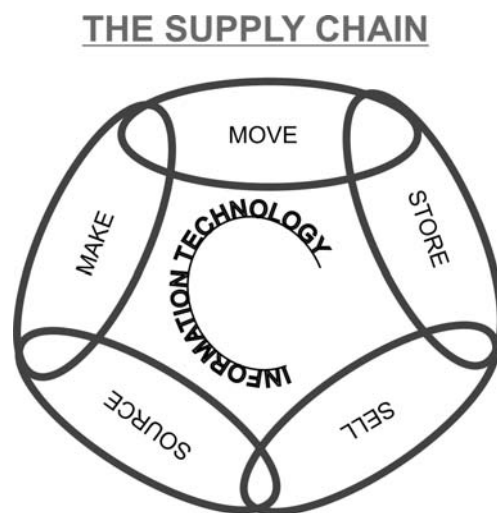


Figure 1. The supply chain

Information is crucial to supply chain performance because it provides the foundation on which managers execute transactions and make decisions. Without information, a manager will not know what customers want, and when product should be produced and shipped. In short, without information managers can only make decisions blindly. Therefore, information makes the Supply Chain visible to a manager. With this visibility a manager can make decisions to improve the Supply chain's performance. In many ways, information is the most important driver and

without it, none of the other drivers, namely,

- Inventory
- Transportation
- Facilities

can be used to deliver a high level of performance.

Information is the factual components on which decision about each of the other drivers are based. In essence, information is the glue that holds the entire Supply Chain together and allows it to function. Thus information is the most important driver.

Information is used when making a variety of decisions about inventories, transportation, and facilities

*Inventory:* Setting optimal inventory policies requires information that includes;

- Demand carrying inventory
- Costs of stocking out
- Costs of ordering

Example: Wal-Mart collects detailed demand, cost, margin, and supplier information to make these inventory policies

*Transportation:* While deciding on transportation networks one has to consider three things, namely,

- Routing modes
- Shipments
- Vendors

All these will require information about cost of transportation by each mode of transportation, customer locations, and shipment sizes to make good decisions

Example: Wal-Mart uses information to tightly integrate its operations with those of its suppliers.

*Facility:* Determining the location, capacity, and schedules of a facility requires information on the trade-offs between efficiency and flexibility, demand, exchange rates, taxes, and so on.

Example: Wal-Mart's suppliers use the demand information from Wal-Mart's stores

to set their production schedules. Wal-Mart uses information about demand to determine where to place its new stores

Apart from information pertaining to the drivers of Supply Chain it also crucial to making good Supply Chain decisions at all three levels of management, namely,

- Strategic Planning
- Management Control
- Operations Control

## 2. THE SUPPLY SOFTWARE

The Supply Chain management (SCM) software solution combines Supply Chain Planning (SCP) and Supply Chain Execution (SCE) systems, that is:

$$(SCM) S/W = (SCP) + (SCE) \text{ systems}$$

Supply Chain Planning (SCP) system provides tools to optimize the entire Supply Chain. A SCP system can examine tradeoffs, and an example of this is asking one part of the organization to incur somewhat higher costs in order to lower total organizational costs. SCP system needs real time feedback to be able to plan effectively.

Supply Chain Execution (SCE) systems provide the real-time data companies need to execute supply chain and logistics plan. SCE applications include:

- Production Scheduling and Execution
- Warehouse Management (WM)
- Transportation Management (TM)
- Advance Order Management (AOM)

Each of these systems can improve efficiency in their domain and help drive overall service improvements.

Supply Chain Management (SCM) benefits cannot be achieved by merely

buying and implementing software. First of all, no single supplier has complete solution. More importantly, the promise of SCM will not be achieved unless the company modifies its internal culture and processes. And yet doing all these things is still not enough. Maximizing total supply chain efficiencies also require better collaboration and cooperation with suppliers and customers. *Achieving Supply Chain Management is a Journey, not an Event.* The structure of a supply chain thus should be both symbiotic (good relation between different types of components, for example, plant and parasite, here man and machine) and synergetic (the total output together should be more than the algebraic sum of individual output that is,  $2+2 >4$ ).

a manager understand how this information is utilized by the various segment of IT within the Supply Chain. The company's supply chain can be grouped into three main macro processes

**Supplier Relationship Management (SRM)** - processes that enable interaction between an enterprise and its suppliers (Source- also known as inbound logistics)

In this software the focus is on the relationship between the enterprise and the suppliers

Here the key objective is Just in Time supply

Key processes are:

Design Collaboration

- Improve the design of products that have positive Supply Chain characteristics

Table 1. The supply chain procedures

| SUPPLY CHAIN PROCESSES | SUPPLY CHAIN PLANNING                             | SUPPLY CHAIN EXECUTION   |
|------------------------|---|--|
| Source                 | Man, material, money and machine planning         | Spot Buying<br>E-procurement<br>Virtual Market Place<br>Demand Forecasting |
| Make                   | Production planning<br>Multisite factory planning | Production Scheduling  |
| Move                   | Logistic planning                                 | Transportation Management  |
| Store                  | Distribution planning                             | Warehouse Management   |
| Sell                   | Demand planning                                   | Advance Order Management<br>Available to Promise                           |

### 3. THE SUPPLY CHAIN IT FRAMEWORK

Given the wide realm of information, it is important to develop a frame work that helps

through joint effort of manufacturer and suppliers

- Sharing of engineering change

Source

- Qualifies suppliers and helps in supplier

selection, contract management, and supplier evaluation

- Evaluating suppliers on the basis of lead time, reliability, quality, and price.

Helps improve supplier performance

#### Negotiate

- Starts with request for quote (RFQ)

- Design and execution of auctions

- Negotiates an effective contract that specifies price and delivery parameters for suppliers in a way that best matches the enterprise needs

#### Buy

- Actual procurement of material

- Creation, management and approval of purchase orders

#### Supply Collaboration

- collaborating on forecasts, production plans, and inventory levels

**Internal Supply Chain Management (ISCM)** - processes focused on the internal operation of an enterprise (Make)

Here the focus is processes which are internal in an enterprise.

The key objective is to fulfill demand that is generated by CRM processes

Key Processes are:

#### Strategic Planning

- Plan resources availability in the supply chain network

- Location of plant and warehouses

- Types of facilities to build

- What market to serve from each facility?

#### Demand Planning

- Forecasting future demand

- Manage demand, such as, promotion planning

#### Supply Planning

- Input from demand planning and strategic planning together produces a production plan to meet this demand

#### *Fulfillment*

- Links each order to a specific supply source and means of transportation

#### *Field Service*

- Setting inventory levels for spare parts

- Scheduling service calls

**Customer Relationship Management (CRM)** - enable interaction between an enterprise and its customer (Move, Store, and Sell- also known as out bound logistics)

### 3. CUSTOMER RELATIONSHIP MANAGEMENT

The most important software to enable interaction between an enterprise and its customers is the Customer Relationship Management (CRM)

The main objectives of CRM are:

- Generate customer demand

- Facilitate transmission and tracking

The key processes of CRM are:

#### *Marketing*

Which customer to target?

How to target the customer?

What product to offer?

How to manage the actual campaign targeting customers?

#### *Sell*

Focus on actual sale to a customer

Information to sales force to make a sale

Ability quote a due date

Access information related to a customer

Order Management - the key issues are:

Managing customer order

Plan and execute order fulfillment

- Matching order(demand) and supply

Call/service Center - the key issues are:

- Helps customer place order

- Suggests products
- Solves problems
- Provides information on order status

- Quick response, or
- Vendor management Inventory Programs (VMI)

IT is a large enabler of these processes as well as enabling integration across these processes.

The macro processes, must focus on the following three factors for their success:

- Functional performance
- Integration with other macro processes
- Strength of the software firm's eco system

We must note that there is a fourth important software building block that provides the foundation upon which the macro processes rest We call this category the Transaction Management Foundation (TMF), which include basic ERP systems (and its components such as financial and human resources), infrastructure software and integration software. TMF software is necessary for the three macro process to function and to communicate with each other

## 4. TYPES OF SUPPLY CHAIN

### 4.1. Distribution Intensive Supply Chain

*Example:* consumer packaged producers

In this type of Supply Chain manufacturers are focusing on

- Reducing delivery response times
- Engaging in frequent and retailers specific product promotions
- Delivering product packaged according to retailer requirements
- Lowering retail inventory through
- More frequent deliveries, or

*Note:* VMI means that the manufacturer has ownership of inventory, as opposed to the retailer, and the manufacturer maintains a high degree of responsibility to stock appropriate levels of product at the retailer's distribution centers or stores.

In this segment manufacturers should use:

- Advance Order management
- Transport management Systems
- Warehouse Management Systems

### 4.2. Sourcing Intensive Supply Chain

*Example:* Companies that compete in industries with short product life cycle - consumer electronic goods, and apparels)

In this type of Supply Chain the focus is on:

- Scheduling packages that allocates available supply to orders where all parts required to build complete, shippable units are available
- Intelligent system that retain component-product relationships, including allowable alternatives, and are able to explore thousands of order completion combination
- Built up to common level of assembly, but the finishing touches are not completed until consumer demand
- Transport Management System
- Export-import process management
- Global logistic tracking

### 4.3. Manufacturing Intensive Supply Chain

*Example:* Industrial equipment, aerospace and defense, heavy metals, and

semiconductors-that is, capital intensive industries

In this type of Supply Chain the focus is on:

- Real time scheduling
- Scheduling engine triggering movements in the material handling system
- Faster order-to-delivery cycles with higher service levels.
- Make-to-order and mass customization
- Product configurations and available-to-promise modules
- Achieving available-to-promise but keeping inventory level lean(requires multi-facility planning and a planning engine that can quickly create plans)
- Collaboration with key suppliers
- Through Transportation Management ((TM)) keeping track of delivery in real-time.
- During periods of high demand help planner to make decisions to minimize

missed due date.

- Demand management system that can produce optimal plans for periods of high and low demand.
- Ability to level out uneven demand pattern, by pushing or pulling orders.

**5. DIESEL LOCOMOTIVE WORKS: A CASE STUDY**

Diesel Locomotive Works (DLW) located in the holy city of Varanasi, India is one of the largest diesel locomotive builders in the world. It was set up in 1964 and has manufactured nearly 44000 locomotives since then. Initially it had taken the technology from ALCO (USA) and later on (in 1998) from general Motors. It has state of art design, manufacturing, and integration.

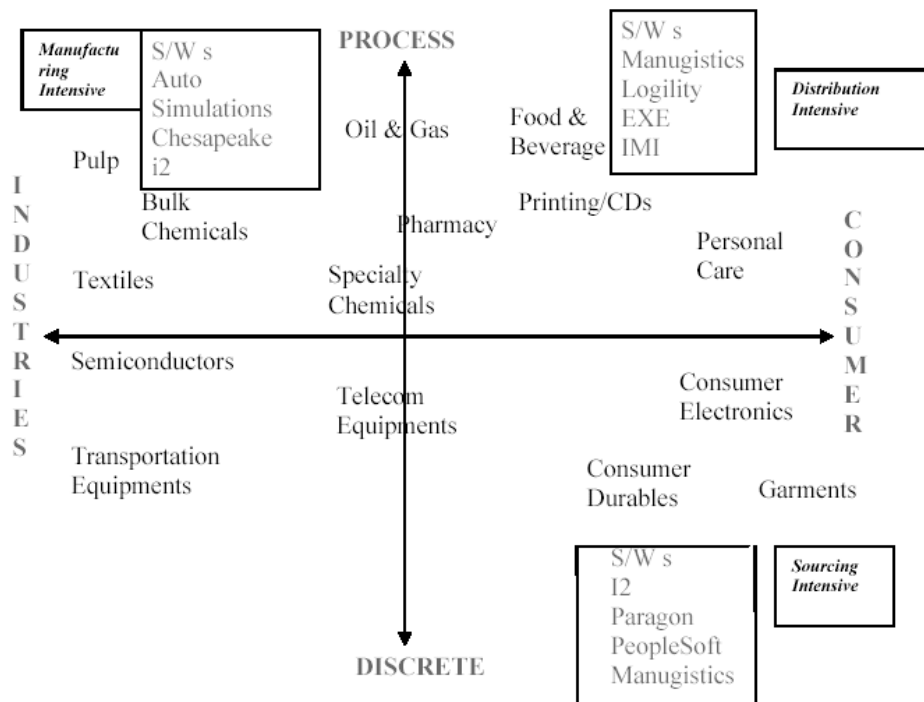


Figure 2. S/Ws commonly used in different types of supply chain



Some of the vital statistics of DLW are the following:

- Large Product Range --- over 10 types
- Large Supplier Base ---- several hundred
- Large Customer Base --- Railways as well as Non - Railways
- Turnover ----- nearly 9000 Crores Indian Rupees
- Locomotive and After Sales Support
- Sales of Spares ----- a large business
- Turnkey Projects ----- in areas of sales, operations, and maintenance
- Emerging Area ----- DG sets
- It is a ISO9001:2000 and ISO:14000 certified

DLW's important customers are the following:

- Indian Railways
- Port Trusts of India
- Steel Plants --- SAIL
- Refineries
- NTPC
- State Electricity Boards
- Sri Lanka
- Bangla Desh
- Vietnam
- Malaysia
- Tanzania
- Working on - Sudan, Iran, and Columbia

Keeping in mind its huge infrastructure and importance DLW is using Information Technology (IT) to make its Supply Chain more effective and efficient. Total number of parts being manufactured at DLW is about 9000. The technology which they had taken from ALCO initially, has been indigenized to about 90-95 per cent and the recently acquired technology from General Motors is also being rapidly indigenized (nearly 60 per cent indigenous)

Since the quality of the products being manufactured by DLW is dependent upon the parts and materials they buy, they have gone in for massive supplier development program. They have carefully selected their vendors. Made a computer based database of their vendors and have classified them in three categories - A, B, and New. This database is both for in-house use and as well as acts as a guide to other loco users. The Vendor development Machinery helps in the supplier development in the following way:

- Multi Stage Supplier approval
- Potential supplier assessment
- Prototyping
- Scaled - up Production
- Helping suppliers to get ISO:9000 certification
- DLW engineers visit the suppliers on a regular basis and also conduct Workshops for them at DLW
- Appropriate technology is made available to Indian vendors
- Often pay development costs
- Quality is give paramount importance
- Long term contracts are preferred

To have control over inventory they use ABC analysis of inventory:

- Category A Rs 2.21 Crore + 61 items
- Category B Rs.0.28 - 2.21 Crore 221 items
- Category C < Rs. 0.38 Crore 8479 items

With proper linkage with their suppliers they have optimized their inventory:

- Category A - almost Just -in -Time (JIT) - 2-10 days
- Category B - deliveries 5-12 times a year
- Category C - deliveries 2-3 times a year

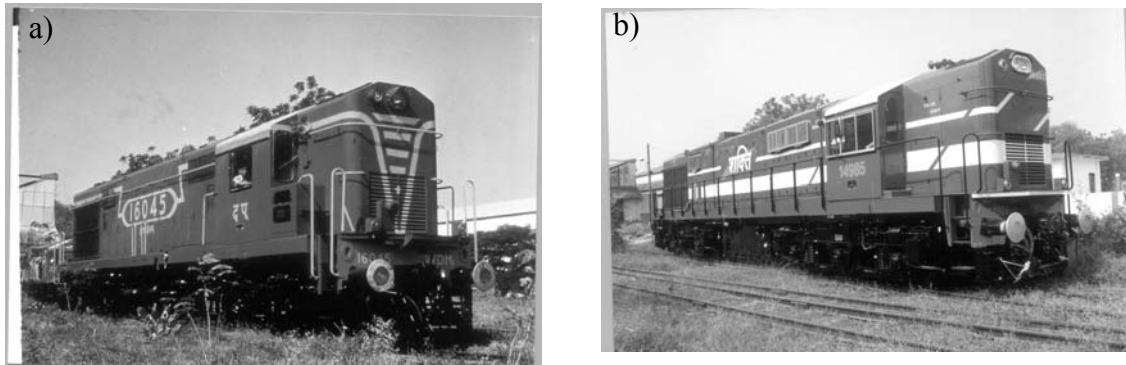


Figure 3. Some Locomotives Being Manufactured At DLW: a) WDM2, 2600 HP, DC/DC BG Mixed Traffic, b) WDG3A, 3100 HP, AC/DC, BG Freight

Suppliers know DLW's production plan and mutual effort is made to match each other paces.

Today they have fully computerized purchase system, 100 per cent Inventory database is maintained, all suppliers documents like - challans, bills, inspection certificates are processed electronically. Bill payments are also largely automated. All information to the suppliers is also automated. Over the years this exercise has paid rich dividend.

This is a 'win-win' situation for both DLW and its suppliers. The suppliers have benefited in the following ways:

- Low inventory at their end
- Quick cash turnover
- Flexible manufacturing to keep pace with change in products
- Feeling of partnership
- Transparency in transactions
- Vital stage information automatically pushed to suppliers

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