



**ISLAMIC UNIVERSITY OF TECHNOLOGY
MECHANICAL AND CHEMICAL ENGINEERING DEPARTMENT**

Project Title
**STUDY OF SUPPLY CHAIN MANAGEMENT
OF AN INDUSTRY**

SUPERVISED BY
Dr. Abu Raihan Md. Harunur Rashid

PREPARED BY
MIRZA ABU FAHIM
ST.# 081437
MCE DEPT.

In the name of almighty ALLAH. most gracious, most merciful.

I hereby approve the project entitled :

"STUDY OF SUPPLY CHAIN MANAGEMENT"

Prepared by :

.....
MIRZA ABU FAHIM

SUPERVISOR:

.....
Dr. Abu Raihan Md. Harunur Rashid

DATE: 07/10/13

Abstract

Supply chain management (SCM) is a factory management technique that aims at maximum profit from a business by ensuring visibility in the supply chain. SCM is a dynamic management tool, which is a combination of many analytical applications & management systems such as transportation management, supplier selection and management system (SSMS), customer focus in a supply chain etc. The implementation of the analytical applications helps in factory management systems take care of the decisions on issues external to the manufacturing factory but within the supply chain. The role of information technology in a supply chain is very significant and facilitates the introduction of SCM software. The emergence of business-to-customer (B2C) & business-to-business(B2B) added a new dimension to supply chain management.

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CHAPTER ONE
INTRODUCTION

1.1 Introduction to the project

This project deals with the study of supply chain management (SCM), a factory management technique that aims at maximum profit from a business by ensuring visibility in the supply chain. Supply chain management is a dynamic management tool, which is a combination of many application and management systems like advanced planning and scheduling, transportation management system, demand management system, inventory management systems, supplier selection and management systems.

1.2 Objective of this project

- To be familiar with the supply chain management.
- To know about the driving parameter of supply chain management of an industry.
- To know about the decision phases of SCM of an industry.
- To know about different stages of supply chain of an industry.

Chapter Two
OVERVIEW OF THE FACTORIES
VISITED

2.1 BATB (British American tobacco ltd.)

British American Tobacco, the second largest Tobacco Company in the world is also the world's most global tobacco company. Based in London, UK, it operates in more than 50 countries with the strength of 100,000 employees and sells more than 300 brands in more than 180 markets worldwide.

Product profile : BATB markets three different types of cigarettes in the Bangladeshi market. These three segments are referred inside BATB as

- a) Premium
- b) high
- c) Domestic value for money brands.

2.2 LINDE Bangladesh Ltd.

The Linde Group is a world leading supplier of industrial, process and specialty gases and is one of the most profitable engineering companies. Linde products and services can be found in nearly every industry, in more than 100 countries. A success story that began with the separation of air.

Product Profile :

- a) Industrial gases
- b) Medical gases
- c) Welding materials.

2.3 G.S. Knitting Ltd.

It is a local Bangladeshi knitting factory situated at Gazipur. It takes orders from the garments to supply cloths. It is a medium sized factory with 4 knitting machines.

Product Profile :

Clothes for garments with different patterns.

Chapter Three
SUPPLY CHAIN MANAGEMENT

3.1 Introduction

Supply chain management is the streamlining of a business supply-side activities to maximize customer value and to gain a competitive advantage in the marketplace. Supply chain management (SCM) represents an effort by suppliers to develop and implement supply chains that are as efficient and economical as possible. Supply chains cover everything from production, to product development, to the information systems needed to direct these undertakings.

3.2 Different Modules of SCM :

Supply chain management, a factory management technique that aims at maximum profit from a business by ensuring visibility in the supply chain. Supply chain management is a dynamic management tool, which is a combination of many application and management systems such as

In-factory management :

- > Demand forecasting
- > Aggregate planning
- > Inventory management system

#Transportation management system

#supplier selection and management system(SSMS)

#customer relation management (CRM)

#Information management system.

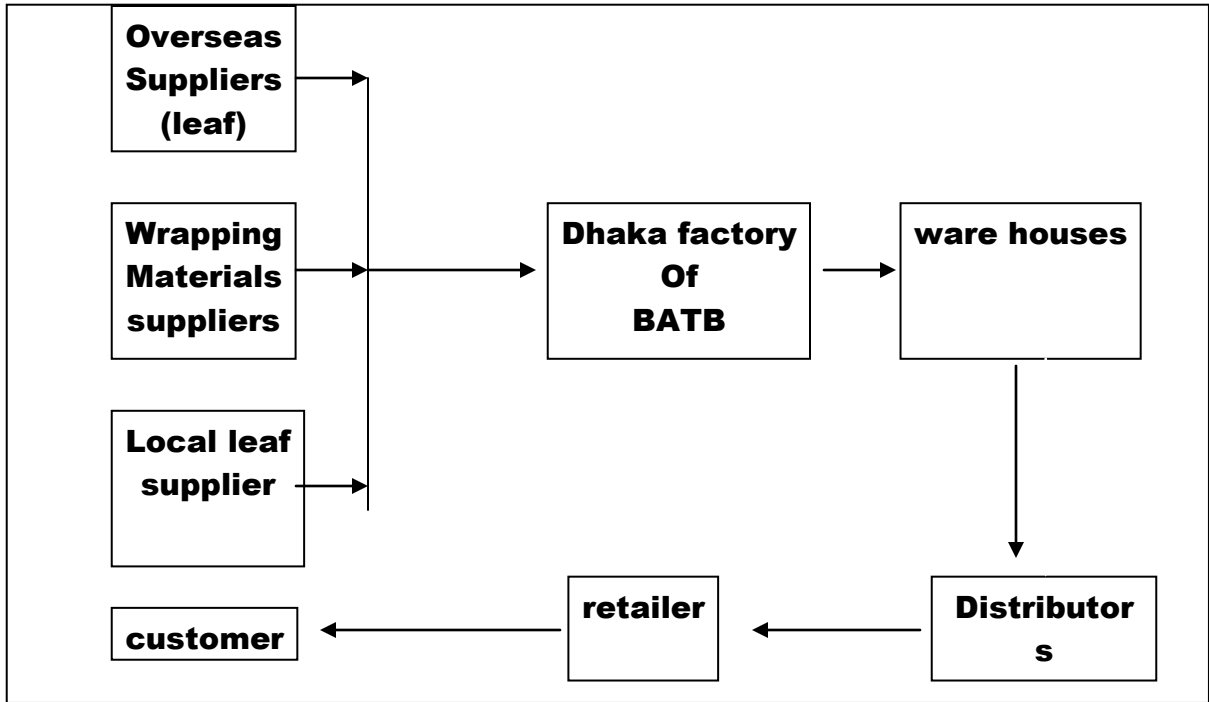


Figure 1 : Supply chain on BATB

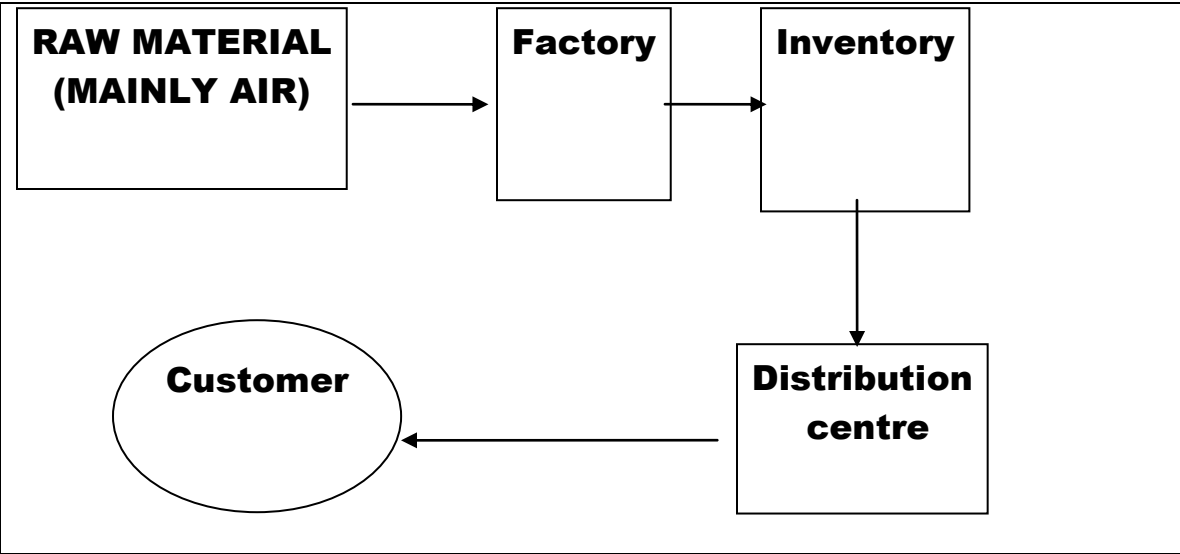


Figure 2 : Supply chain LINDE

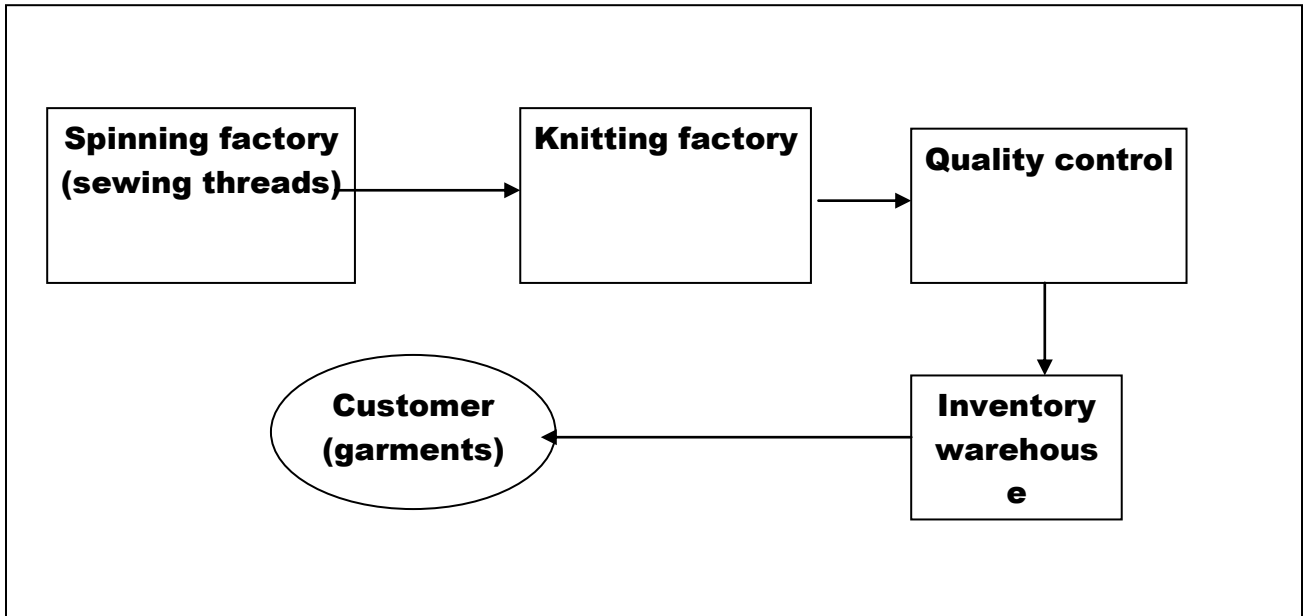


Figure 3 : Supply chain in G.S Knitting Ltd.

Chapter Four

In-factory Management

4.1 Introduction:

In-factory management includes different analytical applications like demand forecasting and aggregate planning and management systems like inventory management system.

4.2 Demand Forecasting :

Demand forecasting is the activity of estimating the quantity of a product or service that consumers will purchase. Demand forecasting involves techniques including both informal methods, such as educated guesses, and quantitative methods, such as the use of historical sales data or current data from test markets. Demand forecasting may be used in making pricing decisions, in assessing future capacity requirements, or in making decisions on whether to enter a new market.

FACTORS TO BE CONSIDERED

- Past demand
- Lead time of product
- Planned advertising or marketing efforts
- State of the economy
- Planned price discounts
- Actions that competitors have taken

METHODS

- Qualitative
- Time series
- Causal
- Simulation

FORECASTING PROCESS IN G.S KNITTING

They use time series forecasting to determine the demand. Time-series forecasting methods use historical demand

TIME (MONTHS OF YEAR 2013)	DEMAND (IN TONS)
JANUARY	18
FEBRUARY	17
MARCH	18
APRIL	22
MAY	20
JUNE	20

Table 1 : PAST DEMAND IN G.S. KNITTING LTD

According to adaptive forecasting forecasting for the month of July,

$$F=(18+17+20+22+18+20)/5=19.6 \text{ tons}$$

But actually the demand was 23 ton so the error is $=23-19.6=3.4\text{tons}$

After observing demand in July, the revised estimate of level for July is given

$$b_y=(23+17+22+20+18+20)/5=24\text{tons}$$

4.3 Aggregate Planning :

Aggregate planning is a process by which a company determines ideal levels of capacity, production, subcontracting, inventory, stock outs, and even pricing over a specified time horizon. The goal of aggregate planning is to satisfy demand while maximizing

profit. Aggregate planning, as the name suggests, solves problems involving aggregate decisions rather than stock-keeping unit (SKU)-level decisions. For example, aggregate planning determines the total production level in a plant for a given month, but it does so without determining the quantity of each individual SKU that will be produced. This level of detail makes aggregate planning a useful tool for thinking about decisions with an intermediate time frame of between roughly 3 and 18 months. In this time frame, it is too early to determine production levels by SKU, but it is also generally too late to arrange for additional capacity. Therefore, aggregate planning answers the question, "How should a firm best utilize the facilities that it currently has?"

The aggregate planner's main objective is to identify the following operational parameters over the specified time horizon:

Production Rate: the number of units to be completed per unit time (such as per week or per month)

Workforce: the number of workers/units of capacity needed for production

Overtime: the amount of overtime production planned

Machine Capacity Level: the number of units of machine capacity needed for production

Subcontracting: the subcontracted capacity required over the planning horizon

Backlog: demand not satisfied in the period in which it arises but carried over to future periods

Inventory on Hand: the planned inventory carried over the various periods in the planning horizon

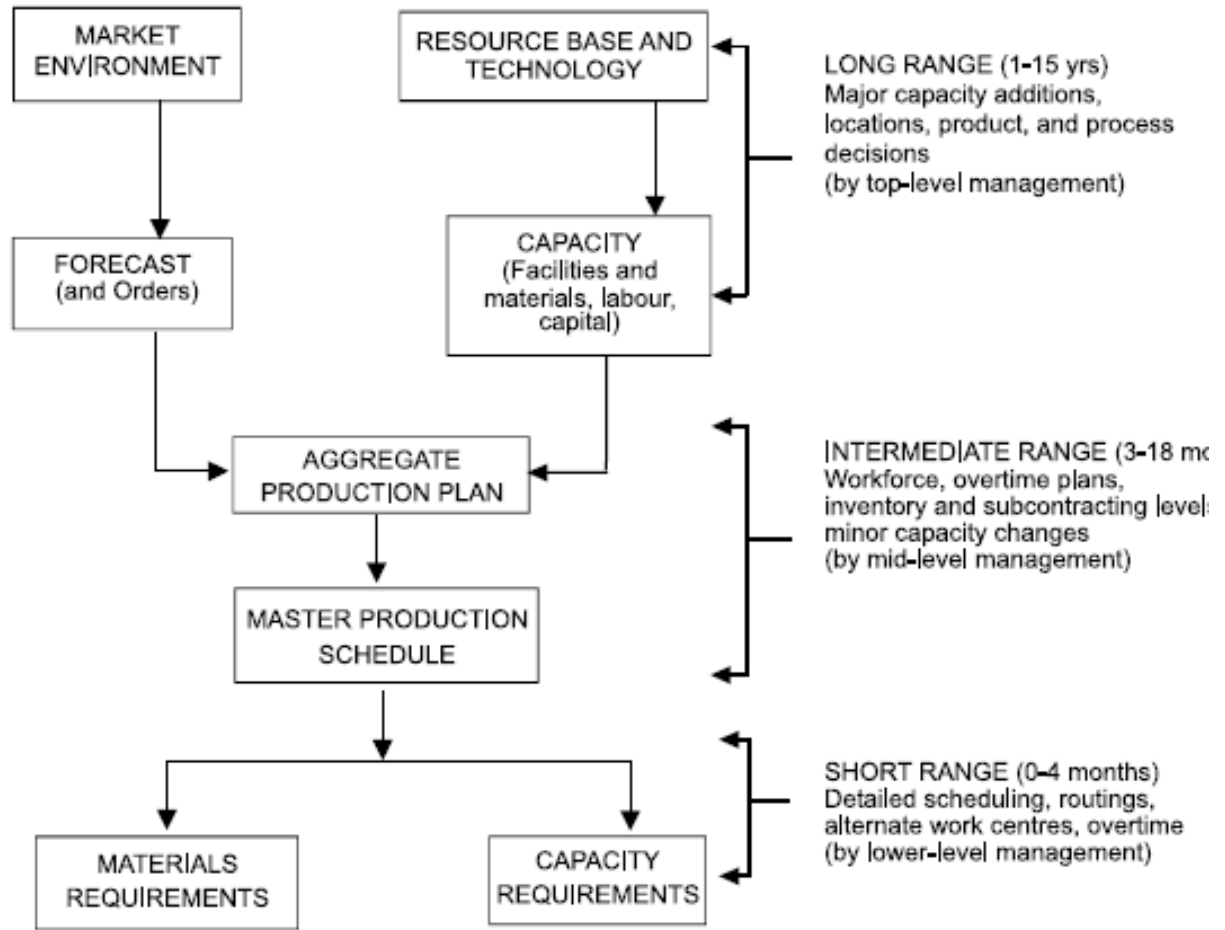


Figure 4: Flow diagram of aggregate planning.

4.4 Inventory management :

Inventory exists in the supply chain because of a mismatch between supply and demand. This mismatch is intentional at a steel manufacturer, where it is economical to manufacture in large lots that are then stored for future sales. The mismatch is also intentional at a retail store where inventory is held in anticipation of future demand. An important role that inventory plays in the supply chain is to increase the amount of demand that can be satisfied by having the product ready and available when the customer wants it. Another significant role that inventory plays is to reduce cost by exploiting economies of scale that may exist during production and distribution.

COMPONENTS OF INVENTORY DECISIONS

We now identify major inventory-related decisions that supply chain managers must make to effectively create more responsive and more efficient supply chains.

Cycle Inventory

Cycle inventory is the average amount of inventory used to satisfy demand between receipts of supplier shipments. The size of the cycle inventory is a result of the production, transportation, or purchase of material in large lots. Companies produce or purchase in large lots to exploit economies of scale in the production, transportation, or purchasing process. With the increase in lot size, however, also comes an increase in carrying costs. As an example of a cycle stock decision, consider an online book retailer. This retailer's sales average around 10 truckloads of books a month. The cycle inventory decisions the retailer must make are how much to order for replenishment and how often to place these orders. Thee-retailer could order 10 truckloads once each month or it could order one truckload every three days. The basic trade-off supply chain managers face is the cost of holding larger lots of inventory (when cycle inventory is high) versus the cost of ordering product frequently (when cycle inventory is low).

Safety Inventory

Safety inventory is inventory held in case demand exceeds expectation; it is held to counter uncertainty. If the world were perfectly predictable, only cycle inventory would be needed. Because demand is uncertain and may exceed expectations, however, companies hold safety inventory to satisfy an unexpectedly high demand. Managers face a key decision when determining how much safety inventory to hold. For example, a toy retailer such as Toys "R" Us must calculate its safety inventory for the holiday buying season. If it has too much safety inventory, toys go unsold and may have to be discounted

after the holidays. If the company has too little safety inventory, however, then Toys "R" Us loses sales, along with the margin those sales would have brought. Therefore, choosing safety inventory involves making a trade-off between the costs of having too much inventory and the costs of losing sales due to not having enough inventory.

Seasonal Inventory

Seasonal inventory is built up to counter predictable variability in demand. Companies using seasonal inventory build up inventory in periods of low demand and store it for periods of high demand when they will not have the capacity to produce all that is demanded. Managers face key decisions in determining whether to build seasonal inventory, and if they do build it, in deciding how much to build. If a company can rapidly change the rate of its production system at very low cost, then it may not need seasonal inventory, because the production system can adjust to a period of high demand without incurring large costs. However, if changing the rate of production is expensive (e.g., when workers must be hired or fired), then a company would be wise to establish a smooth production rate and build up its inventory during periods of low demand. Therefore, the basic trade-off supply chain managers face in determining how much seasonal inventory to build is the cost of carrying the additional seasonal inventory versus the cost of having a more flexible production rate.

Level of Product Availability

Level of product availability is the fraction of demand that is served on time from product held in inventory. A high level of product availability provides a high level of responsiveness but increases cost because a lot of inventory is held but rarely used. In contrast, a low level of product availability lowers inventory holding cost but results in a higher fraction of customers who are not served on time. The basic trade-off when determining the level of product availability is between the cost of inventory to increase product availability and the loss from not serving customers on time.

Techniques of Inventory Control

The different techniques of inventory control are:

ABC analysis, (High value, moderate value and low value)

HML analysis, (high price, medium price and low cost items.)

VED analysis, (vital, essential and desirable items)

FSN analysis, (fast moving, slow moving and non-moving items)

SDE analysis, (the classification of existing inventory is based on the items)

GOLF analysis (Government supply, ordinarily available, local availability and foreign source of supply items) and

SOS analysis (seasonal and off-seasonal items)

INVENTORY IN G.S KNITTING LTD.

In G.S knitting they use the most commonly used ABC method in which the total inventory is categorized into three sub-heads and then proper exercise is exercised for each sub-heads. In this analysis, the classification of existing inventory is based on annual consumption and the annual value of the items. Hence we obtain the quantity of inventory item consumed during the year and multiply it by unit cost to obtain annual usage cost. The items are then arranged in the descending order of such annual usage cost. The analysis is carried out by drawing a graph based on the cumulative number of items and cumulative usage of consumption cost.

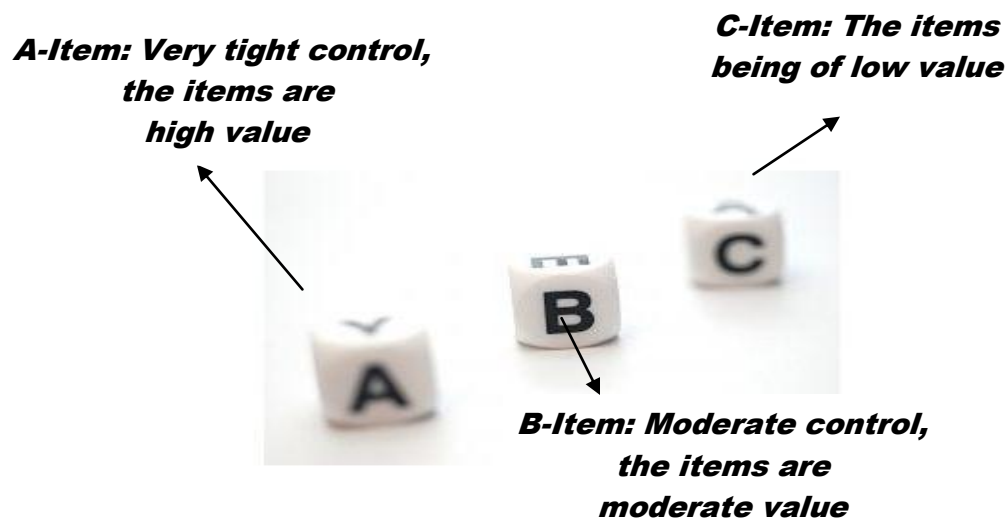


Figure 5: ABC inventory

For item A the maximum inventory is 2 months and minimum is 1 month
For item B the maximum inventory is 4 months and minimum is 3 months
For item C the maximum inventory is 6 months and minimum is 5 months

EOQ (economic order quantity):

Economic Order Quantity (EOQ) is that size of order which minimizes total costs of carrying and cost of ordering. i.e., Minimum Total Cost occurs when Inventory Carrying Cost = Ordering Cost

$$\text{Then, optimal quantity (EOQ), } Q_0 = \sqrt{\frac{2C_3D}{C_1}}$$

In G.S Knitting they do not calculate EOQ but just assume a number but I am giving them a suggestion to minimize their total carrying cost. About 1200 pieces of needles are required per year and per piece needle cost is 23.50 tk and the cost per placement is 6 tk and carrying cost is 0.15 Tk. per piece so according to the formula we get,

$$\begin{aligned} \text{EOQ} &= \{(2*6*1200)/(23.50*.15)\}^{1/2} \\ &= 63.9 \sim 64 \end{aligned}$$

Chapter Five
Transportation Management

5.1 Introduction:

Transportation moves product between different stages in a supply chain. Like the other supply chain drivers, transportation has a large impact on both responsiveness and efficiency. Faster transportation allows a supply chain to be more responsive but reduces its efficiency. The type of transportation a company uses also affects the inventory and facility locations in the supply chain. Dell, for example, flies some components from Asia because doing so allows the company to lower the level of inventory it holds. Clearly, such a practice also increases responsiveness but decreases transportation efficiency because it is more costly than transporting parts by ship.

5.2 Modes of Transportation:

Supply chains use a combination of the following modes of transportation:

- Air
- Package carriers
- Truck
- Rail
- Water
- Pipeline
- Intermodal

Transportation in LINDE :

In LINDE Bangladesh there are various modes of transportation for the products. They have tanker and bulk carrier which are known as prime movers and also trucks and covered van.

ROUTE: there are 99 major routes

Distribution centre: there are 18 sales centre all over Bangladesh

Chapter Six
Supplier Selection and Management
system

6.1 Introduction:

Supplier selection is the process by which firms identify, evaluate, and contract with suppliers. The supplier selection process deploys a tremendous amount of a firm's financial resources. In return, firms expect significant benefits from contracting with suppliers offering value. This article describes the typical steps of supplier selection processes:

identifying suppliers, soliciting information from suppliers, setting contract terms, negotiating with suppliers, and evaluating suppliers.

6.2 Methodology:

The process of selection of supplier involves two basic aspects:

- a) searching for all possible sources
- b) and short listing out of the identified sources.

The complete information about the supplier is available from various sources, such as,

- trade directories,
- advertisement in trade journals,
- Direct mailing by the suppliers,
- interview with suppliers, salesmen,
- suggestions from business
- associates, visit to trade fair, participation in industries convention, etc.

There are three stages of selection of suppliers:

Survey stage:

to locate the appropriate sources of the supplier of various types of materials. Possible sources of supply can be found in:

- a) Specialized trade directories.
- b) Assistance of professional bodies or consultants.
- c) The buyer's guide or purchase handbook.
- d) The manufacturer's or distributor's catalogue.
- e) Advertisements in dailies.
- f) Advertisement in specialized trade journals.
- g) Trade fair exhibitions.

Inquiry stage :

The survey stage highlights the existence of the source. A business inquiry is made with the appropriate supplier. It is known as 'Inquiry Stage'. Here a short listing is made out of the given sources of suppliers in terms of production facilities and capacity, financial standing, product quality, possibility of timely supply, technical competence, manufacturing efficiency, general business policies followed, standing in the industry, competitive attitude, and interest in buying orders etc.

Evaluation and selection of supplier :

The purchase policy and procedure differ according to the type of items to be purchased. Hence, evolution and selection of the supplier differ accordingly. In the 'purchasing handbook' edited by Aljian, it has been described that the following variables to be considered while evaluating the quotations of the suppliers:

Variables to be considered while evaluating the quotations of the suppliers:

1. Cost Factors

Price, transportation cost, installation cost if any, tooling and other operations cost, incidence of sales tax and excise duty, terms of payment and cash discount are considered in cost factor.

2. Delivery

Routing and F.O.B. terms are important in determining the point at which the title to the goods passes from vendor to the buyer and the responsibility for the payment of the payment charges.

3. Design and Specification Factors

Specification compliance, specification deviations, specification advantages, important dimensions and weights are considered in line with the demonstration of sample, experience of other users, after sale services etc.

4. Legal Factors

Legal factors include warranty, cancellation provision, patent protection, public liability, federal laws and reputation compliance

5. Vendor Rating

The evaluation of supplier or vendor rating provides valuable information which help in improving the quality of the decision. In the vendor rating three basic aspects are considered namely quality, service and price. How much weight should be given to each of these factors is a matter of judgment and is decided according to the specific need of the organization.

Following methods for evaluating the performance of past suppliers may be used.

1. The categorical plan method
2. The weighted-point method
3. The cost-ratio plan method

Chapter Seven
SCM SOFTWARE

SCM Software :

Supply chain software refers to the range of tools that are designed to control business processes, execute value chain transactions and manage supplier relationships. While functionality in these systems varies tremendously, common features include purchase order fulfillment, shipping, inventory and warehouse management, and supplier sourcing.

Many supply chain management systems include forecasting, which helps companies manage the fluctuations in supply and demand by use complex algorithms and consumption analysis to evaluate buyer histories. Supply chain optimization software can be an invaluable tool in maximizing production efficiency and planning for the future.

SCM Software evaluation :

The supply chain management software evaluations are broken down into 5 areas which include Company Background, Vertical Markets, Application Software (Products), SCM Features, and Strengths & Weaknesses. The bulk of the evaluation concentrates on SCM Features as well as Strengths & Weaknesses. A common review, comparison and presentation structure is used to provide a consistent evaluation basis. The area of Strengths and Weaknesses provides a level of unique context for individual value of based on any particular vendor's SCM features.

The supply chain management software features evaluated for each software vendor include:

Software Architecture and Cross Application Solutions – Software application vendors offer some form of a software architecture for handling common IT functionalities and/or shared services.

Sales and Operation Planning – Only a few software vendors supported a fully functional S&OP solution. Most software applications have some level of support for the S&OP process.

Demand Management – The supply chain software evaluation focused on forecasting, demand shaping and order fulfillment. Most technology vendors addressed forecasting and order fulfillment. Although some vendors addressed promotions, demand shaping often falls more into Customer Relationship Management (CRM) software solution. Vendors with an integrated CRM generally fare better in demand shaping.

Supply Management – Supply management is a area with highlights the greatest differences between distribution software vendors. The technology vendors developed

their business applications to meet a diverse set of requirements and the levels of product maturity are at vastly different stages.

To maintain a common software evaluation structure, feature sets were further broken down into:

- Strategic Network Planning (SNP) – SNP is becoming a standard feature for many SCM vendors. SNP is a mid-term to long-term supply chain planning tool.
- Distribution Planning – Distribution Planning is a mid-term inventory management and planning tool.
- Replenishment – Replenishment addresses short-term inventory and demand fulfillment planning.
- Vendor Managed Inventory (VMI) – Vendors ability to replenish customer inventory based on stock and sales data sent to the vendor from the customer. The vendor plans and manages the replenishment of goods.
- Procurement Management – Procurement Management plans and executes sourcing strategies.

Warehouse Management Systems – Most of the best practices for WMS are well established, thus the features for each software vendor are often similar. Each vendor was evaluated for the following:

- Yard Management
- Inbound Processing
- Outbound Processing
- Cross Docking
- Value Added Services
- Storage

Transportation Management Systems – As with WMS, often the TMS features appear similar among SCM software vendors. Each SCM vendor was evaluated for the following:

- Planning
- Dispatch
- Freight Charges and Settlements
- Fleet Management

Supplier Relation Management – Most application suppliers did not have a full featured SRM. If they did, they were evaluated for the following:

- Catalog Management
- Sourcing
- Contract Management

- Supplier Compliance

Customer Relationship Management – CRM often addresses key objectives, functionality and integration critical to SCM demand management. CRM captures short-term and mid-term information relevant to demand planning.

CHAPTER EIGHT
CONCLUSION

Conclusion :

A supply chain system is dynamic and involves the constant flow of information among different stages. Supply chain ensure flexibility and low cost of inventory. Can improve profitability of a company. The benefit of supply chain is huge it makes production process and customer service lean and faster. In my project i showed some mathematical processes for better inventory and forecasting of a company which doesn't use modern SCM software or follow methods and gave suggestion to improve their production. I hope that my suggestion would be helpful for the industry managers.

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