

POST GRADUATE DIPLOMA IN MANAGEMENT

MP-09

Logistics & Supply Chain Management

Block

2

MANAGING FLOWS AND NETWORKS

Unit-1

Managing Flows in Supply Chain Management

Unit-2

Managing Networks

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POST GRADUATE DIPLOMA IN MANAGEMENT

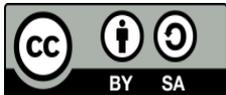
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Unit- 1

Managing Flows in Supply Chain Management

Learning Objectives

After completion of the unit, you should be able to:

- Explain the process of flows in of Supply Chain Management
- Understand five major flows in supply chain
- Understand finance flow
- Understand product flow
- Understand information flow&
- Understand risk flow
- Find the ways and means to optimize selling cost and make competitive.

Structure

- 1.1 Introduction
- 1.2 The Five Major Flows in Supply Chain
- 1.3 Integration of Flows in Supply Chain
- 1.4 Why Supply Chain Flows are Important? A case Study
- 1.5 Financial Flows in Supply Chain
- 1.6 Let's sum-up

- 1.7 Key Terms
- 1.8 Self-assessment Questions
- 1.9 Further Readings
- 1.10 Model Questions

1.1 INTRODUCTION

Supply Chain Management (SCM) can be defined as an integrated process of management of acquisition and management of flow of supply by balancing supply and demand with optimal management of resources with the objective of establishing relationships for maximizing value for mutual benefits of stake holders on economically, socially and environmentally sustainable basis.



In this definition the focus is on acquisition, management of flow, value addition, integration, balancing supply and demand, optimal management of resources, relationships, maximizing value for mutual benefits and economical, social and environmental sustainability. Let us discuss here on core aspect of flow of management:

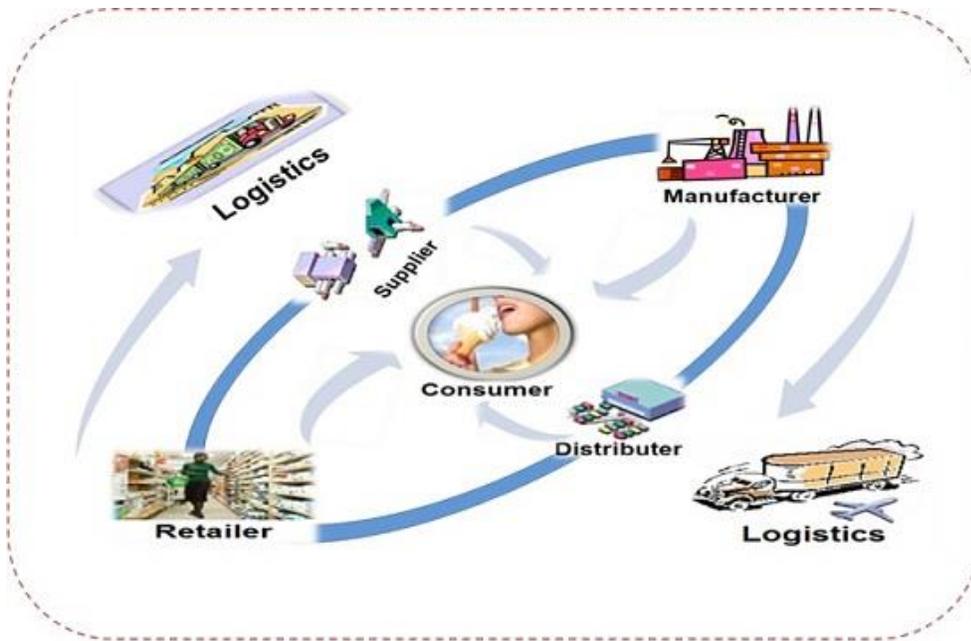
MANAGEMENT OF FLOW:

Supply chain is a process of flow – there is supply of input which is processed / converted to add value and delivered as output. The flow may be goods or services; information flow; the flow of financial resources, value flow with value addition at each stage or activity and also flow of risk. A supply chain is a network of activities from supply side to demand fulfillment via various channels till the end customers; it is not an isolated process; it is an integrated system – interlinking various activities interwoven with value chain.

In a supply chain the materials shall flow from point of origin to point of consumption in a series of chains – one being a supplier of input to the next level consumer, he in turn after value addition supply to next downstream consumer - and the chain continues till the ultimate consumer. Associated with material flow, there are information, finance, value and risk also flow. Thus supply chain management is a management of flow of supply. Before moving to management of flow, let us discuss how Supply Chain integrates different activities, processes and functions.

SUPPLY CHAIN INTEGRATION:

Traditionally various supply functions have been managed in isolation, often working at cross purposes. However in Supply Chain Management these functions are integrated. There are varying degrees of integration within the company between various activities, processes and functions as well as integration of activities which span the boundaries of organisation. Thus Supply Chain Integration refers to both Internal and External Integration.



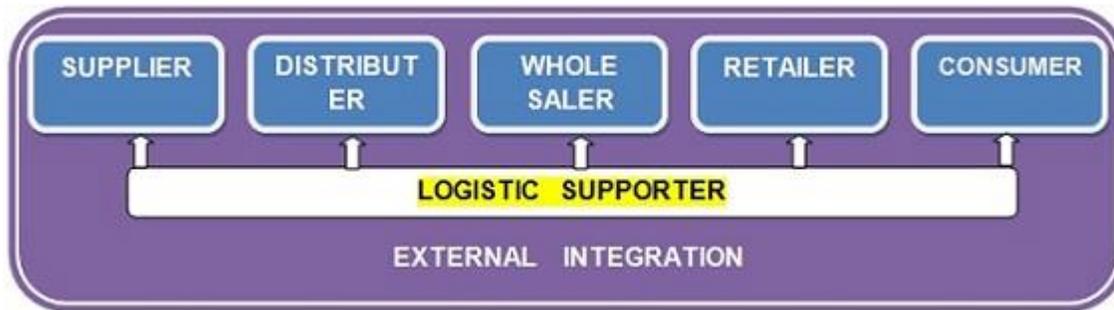
INTERNAL INTEGRATION:

Internal integration refers to linking of internal cross-functional integration within the company like integration between purchasing and procurement (buy), production planning and control (make), warehouse management (store), transport management (move) and customer relationship management (sell)



EXTERNAL INTEGRATION:

External integration refers to linkages of external players such as suppliers, distributors, wholesalers, retailers, customers, outsourced logistic supporters and other external stake holders.



1.2 The Five Major Flows in Supply Chain

Supply Chain is the management of flows. There are FIVE major flows in any supply chain: product flow, financial flow, information flow, value flow & risk flow.

The product flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. The financial flow consists of credit terms, payment schedules, and consignment and title ownership arrangements. The information flow involves product fact sheet, transmitting orders, schedules, and updating the status of delivery.

THE PRODUCT FLOW:

Product Flow includes movement of goods from supplier to consumer (internal as well as external), as well as dealing with customer service needs such as input materials or consumables or services like housekeeping. Product flow also involves returns / rejections (Reverse Flow).

In a typical industry situation, there will a supplier, manufacturer, distributor, wholesaler, retailer and consumer. The consumer may even be an internal customer in the same organisation. For example in a fabrication shop many kinds of raw steel are fabricated into different building components in cutting, general machining, welding centres and then are assembled to order on a flatbed for shipment to a customer. Flow in such plant is from one process / assembly section to the other having relationship as a supplier

and consumer (internal). Acquisition is taking place at each stage from the previous stage along the entire flow in the supply chain.

In the supply chain the goods and services generally flow downstream (forward) from the source or point of origin to consumer or point of consumption. There is also a backward (or upstream) flow of materials, mainly associated with product returns.

THE FINANCIAL FLOWS:

The financial and economic aspect of supply chain management (SCM) shall be considered from two perspectives. First, from the cost and investment perspective and second aspect based on from flow of funds. Costs and investments add on as moving forward in the supply chain. The optimization of total supply chain cost, therefore, contributes directly (and often very significantly) to overall profitability. Similarly, optimization of supply chain investment contributes to the optimization of return on the capital employed in a company. In a supply chain, from the ultimate consumer of the product back down through the chain there will be flow of funds. Financial funds (Revenues) flow from the final consumer, who is usually the only source of “real” money in a supply chain, back through the other links in the chain (typically retailers, distributors, processors and suppliers).

In any organization, the supply chain has both Accounts Payable (A/P) and Accounts Receivable (A/R) activities and includes payment schedules, credit, and additional financial arrangements – and funds flow in opposite directions: receivables (funds inflow) and payables (funds outflow). The working capital cycle also provides a useful representation of financial flows in a supply chain. Great opportunities and challenges therefore lie ahead in managing financial flows in supply chains. The integrated management of this flow is a key SCM activity, and one which has a direct impact on the cash flow position and profitability of the company.

THE INFORMATION FLOW:

Supply chain management involves a great deal of diverse information—bills of materials, product data, descriptions and pricing, inventory levels, customer and order information, delivery scheduling, supplier and distributor information, delivery status, commercial documents, title of goods, current cash flow and financial information etc.—and it can require a lot of communication and coordination with suppliers, transportation vendors, subcontractors and other parties. Information flows in the supply chain are bidirectional. Faster and better information flow enhances Supply Chain effectiveness and Information Technology (IT) greatly transformed the performance.

THE VALUE FLOW:

A supply chain has a series of value creating processes spanning over entire chain in order to provide added value to the end consumer. At each stage there are physical flows relating to production, distribution; while at each stage, there is some addition of value to the products or services. Even at retailer stage though the product doesn't get transformed or altered, he is providing value added services like making the product available at convenient place in small lots.

These can be referred to as value chains because as the product moves from one point to another, it gains value. A value chain is a series of interconnected activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various product services), delivery to final customers, and final disposal after use. That is supply chain is closely interwoven with value chain. Thus value chain and supply chain are complimenting and supplementing each other. In practice supply chain with value flow are more complex involving more than one chain and these channels can be more than one originating supply point and final point of consumption.

In chain at each such activity there are costs, revenues, and asset values are assigned. Either through controlling / regulating cost drivers better than before or better than

competitors or by reconfiguring the value chain, sustainable competitive advantage is achieved.

THE FLOW OF RISK:

Risks in supply chain are due to various uncertain elements broadly covered under demand, supply, price, lead time, etc. Supply chain risk is a potential occurrence of an incident or failure to seize opportunities of supplying the customer in which its outcomes result in financial loss for the whole supply chain. Risks therefore can appear as any kind of disruptions, price volatility, and poor perceived quality of the product or service, process / internal quality failures, deficiency of physical infrastructure, natural disaster or any event damaging the reputation of the firm. Risk factors also include cash flow constraints, inventory financing and delayed cash payment. Risks can be external or internal and move either way with product or financial or information or value flow.

External risks can be driven by events either upstream or downstream in the supply chain:

- Demand risks – related to unpredictable or misunderstood customer or end-customer demand.
- Supply risks – related to any disturbances to the flow of product within your supply chain.
- Environment risks – that originate from shocks outside the supply chain.
- Business risks – related to factors such as suppliers' financial or management stability.
- Physical risks – related to the condition of a supplier's physical facilities.

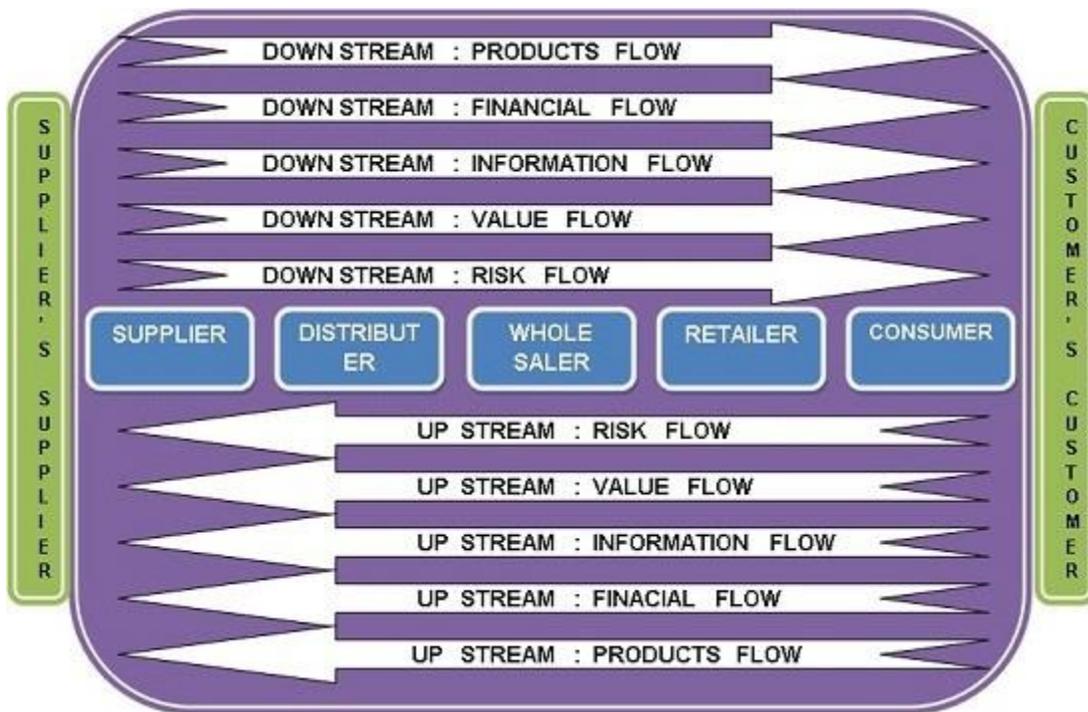
Internal risks are driven by events within company control:

- Manufacturing risks – caused by disruptions of internal operations or processes.
- Business risks – caused by changes in key personnel, management, reporting structures, or business processes.

- Planning and control risks – caused by inadequate assessment and planning, and ineffective management.
- Mitigation and contingency risks – caused by not putting in place contingencies.

1.3 INTEGRATION OF FLOWS IN SUPPLY CHAIN:

Supply chain management integrates key business processes from end user through original suppliers, manufacturer, trading, and third-party logistics partners in a supply chain. Integration is a critical success factor in a dynamic market environment and is prerequisite for enhancing value in the system and for effective performance of the supply chain by sharing and utilization of resources, assets, facilities, processes; sharing of information, knowledge, systems between different tiers in the chain and is vital for the success of each chain in improving lead-times, process execution efficiencies and costs, quality of the process, inventory costs, and information transfer in a supply chain. Integration leads to better collaboration for synchronized production scheduling, collaborative product development, collaborative demand and logistic planning. Also with increased information visibility and relevant operational knowledge and data exchange, integrated supply chain partners can be more responsive to volatile demand resulting from frequent changes in competition, technology, regulations etc. (capacity for flexibility). Integration is required not only for economic benefits but also for compliances in terms of social and community, diversity, environment, ethics, financial responsibility, human rights, safety, organizational policies, industry code of conduct, various national / international laws, regulations, standards and issues.



1.4 Why Supply Chain Flows are Important? A Case Study

Importance of supply chain flows:

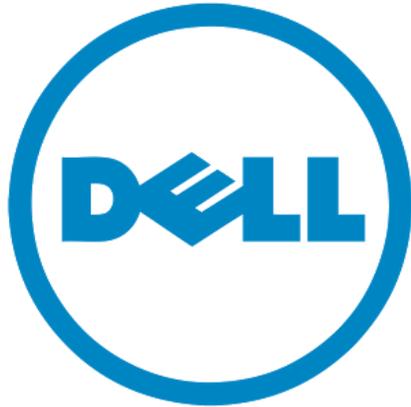
There is a close connection among the design and management of supply chain flows (product, records, and cash) and the fulfillment of a supply chain. McDonald's supply chain flow chart can be discussed here, but another giant Dell PC is an example of a company that has successfully used precise supply chain practices to help its competitive strategy have been shown here for a case study. Maximum e-business failures also can be attributed to issues with the design and control of supply chain flows.

A Case Study

Dell has, over a particularly quick period, come to be the arena's largest computer manufacturer. They have got generated margins, income, and in the end, marketplace capitalization past any in their competitors' laptop enterprise.

Supply chain management processes followed

Dell has attributed a good-sized a part of its achievement to the manner it manages flows-product, records, and money inside its supply chain diagram.



Dell's primary supply chain model is direct sales to clients. As distributors and retailers are bypassed, the Dell supply chain flow has most effective three ranges-clients, producer, and suppliers. Due to the fact Dell is in direct touch with its customers, it's been able to finely phase them and analyze the needs and profitability of each segment.

Value chain model

Close contact with their customers and an information of clients' wishes also allows Dell to broaden better forecasts. To similarly enhance the suit between supply and demand.

Dell makes a lively effort to steer clients in real time, at the phone or via the net, towards PC configurations that may be built given components available.

At the operational aspect, stock turnover is a key overall performance measure that Dell watches very closely. Dell consists of less than ten days' well worth of stock; in the evaluation, the competition, selling thru shops, consists of within the vicinity of eighty to one hundred days' worth of stock.

Value chain analysis

If Intel introduces a brand new chip, the low level of inventory permits Dell to visit marketplace with a laptop containing the chip quicker than the competitors.

If costs all of the sudden drops, as they regularly do, Dell has less stock that loses valued aboutits competitors. For a few merchandise, along with Monitors via Sony, Dell continues no stock. The transportation organization, correct selections up the right range of computer systems, shape Dell's Austin plant and monitors from Sony's manufacturing unit in Mexico matches them with the aid of client order and promises them to the clients. This method permits Dell to save time and money associated with the greater handling of monitors.

Information flows in Supply Chain

The achievement of the Dell supply chain is facilitated through sophisticated information exchange. As a result of a complete study of a process view of the supply chain, Dell gives real-time records to suppliers at the current kingdom of demand.

Manufacturers are capable of getting entry to their components' inventory tiers on the factories at the side of each day manufacturing necessities. Dell has created customized web pages so that its principal suppliers can view call for forecasts and different purchaser-touchy statistics, accordingly helping suppliers to get a higher idea of consumer demand and better match their manufacturing schedules to that of Dell.

The Corporation has manufacturing concentrated in 5 manufacturing Centers-Brazil, China, Ireland, Malaysia, and Texas; because demand for at every location is distinctly big and solid, suppliers are capable of top off element inventories often, bearing in mind low degrees of stock inventories to be maintained.

In a few cases, Dell incorporates most effective hours of element inventory at its factory. Dell's low stage of stock additionally assists make certain that defects are not introduced into a huge amount of product.

While a new product is launched, Dell engineers are stationed right in the plant. If a consumer calls in with a hassle, production is stopped, and flaws are constant in actual time.

As there may be no finished product in stock, the quantity of faulty merchandise produced is minimized.

Dell also manages its cash flows very efficiently, via dealing with receivables and payables very carefully. They're capable of gather cash from their customers, on common, ten to fifteen days earlier than they must pay their suppliers.

Understanding Supply Chain

Dell's supply chain management cycle combines of design and their management of product, statistics, and cash flows play a vital function in the company's achievement. This technique has left Dell very well positioned in the computer enterprise. Given that PC is to and extent a commodity, the competitive battlefields more centered on supply chain flows responsiveness and performance. This bodes well for Dell.

Key point

The importance of supply chain flows visible in any field of success in business. That's why it's very vital in the aspect of analytical as well as fundamental.

1.5 Financial Flows in the Supply Chain

Great opportunities and challenges lie ahead in managing financial flows in supply chains. In the past thirty years tremendous strides have been made regarding supply chain efficiencies—sharply reduced lead times, lower inventories, more responsiveness, increased variety, more collaboration on planning and forecasting, and improved customer service. In most respects, financial flows are still performing as they did in the 1970's—with significant delays in processing and reconciling invoices, long Days Sales Outstanding (DSO) for accounts receivable (A/R), and significant funds held in Working Capital to deal with uncertainties in inflows and outflows.

Now the financial supply chain is in a critical phase of evolution. New automation solutions show high potential for reducing processing costs significantly. They also offer

enhanced visibility, which means less uncertainty in accounts receivable (A/R) and accounts payable (A/P), hence a significant reduction in Working Capital needs.

Furthermore, they also accelerate the process of procuring goods, which in turn, accelerates payment and invoice reconciliation, and they reduce DSO.

Invoices and Payments

The financial flow in a typical supply chain includes thousands of invoices and payments in a given year.

The scale of this problem is challenging corporations to find ways of streamlining their processing. There are also considerable savings to be obtained in other categories besides processing improvements. Any single organization in the supply chain has both Accounts Payable (A/P) and Accounts Receivable (A/R) activities. Each invoice is an A/P from the downstream buyer's perspective and an A/R from the upstream seller's viewpoint. Multiple invoices, however, are often paid by a single payment. This requires information as to which specific invoices are covered by a remittance. Also, when invoices are reconciled prior to payment, the three-way match of purchase order (P.O.), shipping receipt, and invoice may fail if all documents are not precisely consistent. Both of these potential failures can often be dealt with by innovative payment solutions with pre-established tolerances for automated processing.

Information Transfer

Financial flows also include information transfer via Electronic Invoice Presentment (EIP) and electronic payments. This combination constitutes the Electronic Invoice Presentment and Payment (EIPP), an advanced payment application that automates specific financial tasks, as well as provides the opportunity to collect, aggregate, and share valuable information across the supply chain.

Until recently, information and financial flows were treated separately. However, innovative payment solutions can now include detailed transaction information such as date and time of receipt, supplier name, and quantity received, P.O. number, etc. Having both financial and detailed product information available electronically can

minimize human errors, reduce reconciliation time, and create a more tightly integrated supply chain. Importantly, banks can aid customers in ensuring that reconciliation and posting to General Ledger (GL) is integrated automatically.

Supply Chain Management Challenges

Despite the fact that companies have made a large number of significant supply chain management improvements over the past decade, there are still some unique challenges affecting operational efficiencies and service. The challenges listed here are those most closely related to what is commonly known as the “bullwhip effect,” a term that refers to amplifications of end-consumer demand as one moves up the supply chain. How a company mitigates the bullwhip effect depends on the cause.

CHALLENGE 1: Information Distortion

SOLUTION: Ensure rapid information exchange along the chain

One cause of the Bullwhip Effect deals with information distortion. If consumer sales increase by 5 percent in a given week, a retailer could end up ordering 7 percent more product in response to the increase and a feeling that demand will continue. The next link in the chain, observing what appears to be a 7 percent increase in demand, then orders a larger increase on his supplier. Eventually the factory may observe an inflated 20 percent increase in orders.

Delays in transmitting changes regarding demand or supply can amplify problems. A good way to deal with this situation is to share point-of-sales (POS) information with all partners in the chain. Emerging electronic payment (e.g. card-based solutions) and information management tools provide a new way of sharing information.

SOLUTION: Vendor Managed Inventory (VMI)

Another way to deal with information distortion involves giving the supplier “decision rights” regarding the timing and quantity of replenishments. While many buyers may have concerns about turning

these decisions over to suppliers, there have been numerous successful pilots and full-scale applications of this concept, called Vendor-Managed Inventory (VMI).

CHALLENGE 2: Miscommunication

SOLUTION: Collaboration and Integration

Companies along the supply chain are more collaborative compared to the past. They are sharing forecasts and attempting to operate in a highly integrated fashion so that the end customer perceives the entire supply chain as fully integrated. Collaboration can take several forms. A simple sharing of forecasts between supply chain partners can often avoid miscommunication about special promotions or other events that will affect demand. More complex integration can take the form of VMI.

Financial Flow Management Challenges

Most companies require significant amounts of Working Capital to deal with variable and somewhat unpredictable financial inflows and outflows. When viewed collectively, the financial flow management challenges such as slow processing, unreliable and unpredictable cash flows, costly processes, high Days Sales Outstanding (DSO), and suboptimal credit decisions require higher Working Capital than necessary.

If these challenges were removed, the money saved could be shifted to more valuable uses. In order to strategically address and minimize financial flow challenges and take appropriate action, one must first identify and evaluate the common causes.

Causes

Manual Processes

Manual processes tend to be slow, unreliable, unpredictable, and in the final analysis, often more costly than automated solutions.

Lack of Timely Information

In many situations, financial flows do not contain sufficient detailed information for either manual or automated systems to accomplish their jobs. As a result, additional time and effort is required to obtain missing information (e.g., invoice-level detailed information such as SKU numbers, item quantities, and P.O. numbers).

Lack of Employee Empowerment and Spend Policy Compliance

If purchasing by individuals isn't carefully monitored and controlled, inappropriate spending may occur, undermining the company's initiatives to control expenses and improve strategic sourcing. Strategic sourcing requires companies to know how much they are purchasing from various suppliers for different categories of product. Performing periodic analyses to create reports to help monitor spending and negotiate strategic sourcing with key vendors may be time-consuming and costly if this data is not captured electronically.

Delay in Invoice Reconciliation

Delays in invoice reconciliation are a particular cause of additional Working Capital; they delay receipt of payments and increase Days Sales Outstanding (DSO) of receivables. When there is a three-way mismatch of invoice, P.O., and shipping receipt, there is an inevitable delay while the mismatch is investigated. These investigations typically take time, as well as add cost.

Process for Setting Optimal Limits

Companies often maintain their own departments to set customer credit limits. However, the ability to set optimal credit limits may require sophisticated algorithms that are often inaccessible to non-financial companies.

Results

- High working capital needs,

- High costs,
- High Days Sales Outstanding (DSO) and,
- Lower revenues

The supply chain financial flow is at a critical threshold of evolution. Current trends in supply chain and financial flow management clearly favor the use of automated payment solutions. Continued expansion in this area offers high potential for:

- Reducing significantly purchasing processing costs
- Accelerating payment and invoice reconciliation
- Reducing collections costs significantly and minimizing the number Days Sales Outstanding (DSO)
- Creating greater processing efficiencies in the procurement of goods
- Enhancing visibility, which means less uncertainty in accounts receivable (A/R) and accounts payable(A/P) and a reduction in Working Capital needs

1.6 Let's sum-up

'World Class Best practice' companies have endorsed the concept of supply chain management and optimum management of various flows. Companies in India will have to do the same if they are to be competitive in world markets. This is particularly true as a result of India's very open economy adopted by the Government "Make in India" concept - over 30 per cent of what is produced in India is exported off the country. Given India's peripheral location, companies based here must be better at supply chain management than companies in more favorable locations.

Supply chain management shows that product flow is only one, and not even the most important, cost in the total supply chain. Distance from raw material sources and markets need not be a disadvantage if companies in India can be 'world class' in the other supply chain management elements and to compete with countries like China and European Union. These supply chain management elements include, for example:

- Agile and lean manufacturing;

- Development of supplier partnerships;
- Just in time inventory management;
- Effective use of 3rd and 4th party distribution and logistics service providers.

If companies in India can be world class in these they can successfully compete in world markets. In addition, the entire supply chain does not have to be in one country, so supply chain management allows India based companies compete in the world market as part of a global supply chain. The large number of multinational companies which have chosen to locate in India makes this even more important. Finally, developments in E-business have created 'virtual' supply chain, a development which India is well placed to exploit. Modern techniques in financial flow need to be adopted to reduce the cost of end product at the hands of the end customer.

1.7 Key Terms

Order Cycle time- Cycle time or lead time is the end-to-end delay in a business process. For supply chains, the business processes of interest are the supply chain process and the order-to-delivery process. Correspondingly, we need to consider two types of lead times: supply chain lead time and order-to-delivery lead time.

Internal customer- Internal customers are those colleagues and departments within the own organisation. Looking at internal functions, how marketing can be used internally for the flow of internal services and communication. Sometimes we are the customer and sometimes we are the service provider. We considered how marketing connected internally with how marketing interacts with research and development, production/operations/logistics, human resources, IT and customer service. There are of course many other internal parts of the business.

External customer- External customers are more likely to be customers, users, and stakeholders. Customers are those that exchange money for goods and services and consumers are those that actually use

the product (and as we said they may or may not be the same person). So a user is the same as a consumer. According to Blythe (2011), stakeholders are people who are impacted by corporate activities. An obvious stakeholder might be a shareholder since they have voting rights at annual general meetings. A less obvious stakeholder would be the person that owns the land next to your factory, or the family that is supported by the father that works in your warehouse. So stakeholders would include 'publics' such as shareholders, customers, staff and the local community. A connected stakeholder is one with the direct association with the business, and this would be a supplier or a shareholder. Obviously other stakeholders would not have the same strength of connection, for example in the case of the local community.

Optimal credit limit- A personal finance rule of thumb that goes with it says that for a good credit score, keep your "credit utilization ratio" -- what you use versus how much you have to use -- below 30 percent. The rule applies to each card individually, and to the cumulative limits of all your cards. Credit limit management is of paramount importance for successful short-term credit-risk management, even more so when the situation in credit and financial markets is tense. We consider a continuous-time model where the credit provider and the credit taker interact within a game-theoretic framework under different information structures. The model with complete information provides decision-theoretic insights into the problem of optimal limit policies and motivates more complicated information structures. Moving to a partial information setup, incentive distortions emerge that are not in the bank's interest.

1.8 Self-assessment Questions

Q1. A reason to carry inventory would include:

A) to have tax write-off opportunities

- B) having a wide variety to meet customer expectations
- C) to increase ways to use the product
- D) supplementation of synergy strategies
- E) to promote purchasing and transportation discounts

Ans: E

Q2. Air freight is costly, but its speed may create savings because of:

- A) The extensive availability of airports
- B) Lower inventory.
- C) Getting to store shelves before water carriers.
- D) Lower costs created by FIFO.
- E) Other transportation modes take more time.

Ans: B

Q3. Lead time and order cycle time are the same as:

- A) customer service time
- B) supply chain flow
- C) logistical clockage
- D) replenishment time
- E) real time service time

Ans: D

Q4. Dramatic cost savings are possible when efficient transportation systems and information technology can be substituted for _____ costs.

- A) Advertising
- B) Personal selling
- C) Publicity
- D) Inventory
- E) Billing

Ans: D

Q5. In physical distribution decisions, total logistics cost includes:

- A) Order processing.
- B) Materials handling and warehousing.
- C) Transportation.
- D) Inventory and stockouts.
- E) All of the above.

Ans: E

Q6. A warehouse that emphasizes speed and efficient product flow to hold goods for short periods of time and move them out as soon as possible:

- A) is a storage warehouse.
- B) is a freight forwarder.
- C) is a distribution centre.
- D) is an inventory expediting centre.
- E) has a just-in-time inventory system.

Ans: C

1.9 Further Readings

1. Supply Chain Management by IBS Centre for Management Research
2. Essentials of Supply Chain Management by Michael H Hugos
3. Supply Chain Management by Farooq Soofi
4. Lean Supply Chain- Logistics Management by Paul Myerson

1.10 Model Questions

1. Discuss role of information flow in supply chain and how it contributes to profit maximization.
2. Discuss briefly the various flows in supply chain management.
3. What is flow of risk? Discuss with one example.
4. What is external integration? Elaborate its factors.

Managing Network

Learning Objectives

After completion of the unit, you should be able to:

- Explain what is a Network in Supply Chain Management
- Understand Network Model
- Understand what are the inter-related factors in network
- Understand network optimization and
- Know what is supply chain integration

Structure

- 2.1 Introduction
- 2.2 Network Models
- 2.3 What is a supply chain network?
- 2.4 Inter-related factors in Network
- 2.5 Network Optimization
- 2.6 Let's sum-up
- 2.7 Key Terms
- 2.8 Self-assessment Questions
- 2.9 Further Readings
- 2.10 Model Questions

2.1 INTRODUCTION

The network design in supply chain determines its physical arrangement, design, structural layout and infrastructure of the supply chain. Here the major decisions to be made are on the number, locations and size of manufacturing plants and warehouses and the assignment of retail outlets to warehouses, etc. This stage witnesses some other major sourcing decisions as well. The basic time duration for planning horizon is few years.

Many major decisions involving the long-term location, capacity, technology and supplier selection have to be made by considering the probable uncertainties present in the market development accompanied by changing economic and legal conditions.

The network design in supply chain concentrates mainly on the development of multi-stage stochastic optimization methods required for decision support under demand, freight rate and exchange rate uncertainty. Here, we will discuss the various strategies to study the uncertainty and scenario modeling.

- **Warehouse location**– When companies expand their branches into various new locations, they need new storage places as well. Here the company faces a warehouse location problem. Within the set of probable choices in locations, the one that has minimal fixed costs and operational costs by fulfilling the required demand is chosen.
- **Traffic network design**– With the growing population, the traffic in cities is increasing. Because of the higher transportation demand, the traffic networks have also to be widened. Since the budget allotted is usually limited, the major issue is to determine which projects should be constructed to develop the flow inside a traffic network.
- **Reshoring**– This phenomenon has emerged recently because of the rising cost and other circumstances. It is the exercise of bringing outsourced products and services back to the source point from which they were originally shipped. It outlines the process of moving some or all producing back to its original source.

2.2 Networks Models

Supply chain networks present different types of models that help us understand the various optimization methods used for studying the uncertainty and scenario modeling. There are six distinct supply chain network models, as given below.

- Producer storage with direct shipping
- Producer storage with direct shipping and in-transit merge (cross docking)
- Distributor storage with package carrier delivery
- Distributor storage with last mile delivery
- Producer or distributor storage with customer pickup
- Retail storage with customer pickup

The supply chain network basically deals with three major entities: Producer, Distributor and Merchant. Two different options are available, i.e., customer pickup or door delivery. For example, if the door delivery option is opted for, there is transport between producer and distributor, distributor and merchant and producer and merchant.

The distribution system decision is made on the basis of the choice of the customers. This in turn results in the demand for the product or products and cost of the distribution arrangement.

New companies may come to a halt through the application of a single type of distribution network. Mostly, companies go for merging of different types for distinct products, different customers and different usage situations, coming back to the different optimization models mentioned above. Now we will discuss each model in brief.

Producer storage with direct shipping

In this model, goods are moved directly from the manufacturer's location as the starting point to the end customer's location as the destination point bypassing the retailer. The

retailer is the person who takes the order and initiates the delivery request. This option is also called drop-shipping, with product delivered directly from the manufacturer's location to the customer's destination.

Producer storage with direct shipping and in-transit merge

It is somewhat congruent to pure drop-shipping or moving, but the difference is that pieces of the order come from different locations and they are merged into one so that the customer gets a single delivery.

Distributor storage with package carrier delivery

This comes into action when the inventory is not owned by the manufacturers at the plants; instead it is owned by the merchants/retailers in intermediate warehouses and package carriers are used for shipment of goods from the intermediate location to the final customer.

Distributor storage with last mile delivery

This type results when the merchant/retailer delivers the goods ordered by the customer to the customer's home instead of using a package carrier.

Producer/distributor storage with customer pickup

In this type, the inventory is stored at the warehouse owned by the manufacturer or producer but the customers place their orders online or through phone and then come to pick up points allotted for collecting their orders.

Retail storage with customer pickup

This is mostly applied on situations when inventory is locally stored at retail stores; customers walk into the retail shop or order something online or on the phone and pick it up at the retail store.

2.3 What is a Supply Chain Network?

What is a supply chain network? And why are they so important for logistics and business managers? Supply chain networks allow us to look at the big picture; giving us a better understanding of the flow of materials and information.

Often organisations focus only on their organisation; what they produce or provide and not what the end customer receives. Looking at a supply chain network enables firms to look at the overall movement of materials/information from start to end, allowing organisations to see the value in creating partnerships; and the value in working together to ensure the best possible value is provided to the end-customer.

Supply chains and supply networks both describe the flow and movement of materials & information, by linking organisations together to serve the end-customer.

'Network' describes a more complex structure, where organisations can be cross-linked and there are two-way exchanges between them; 'chain' describes a simpler, sequential set of links.

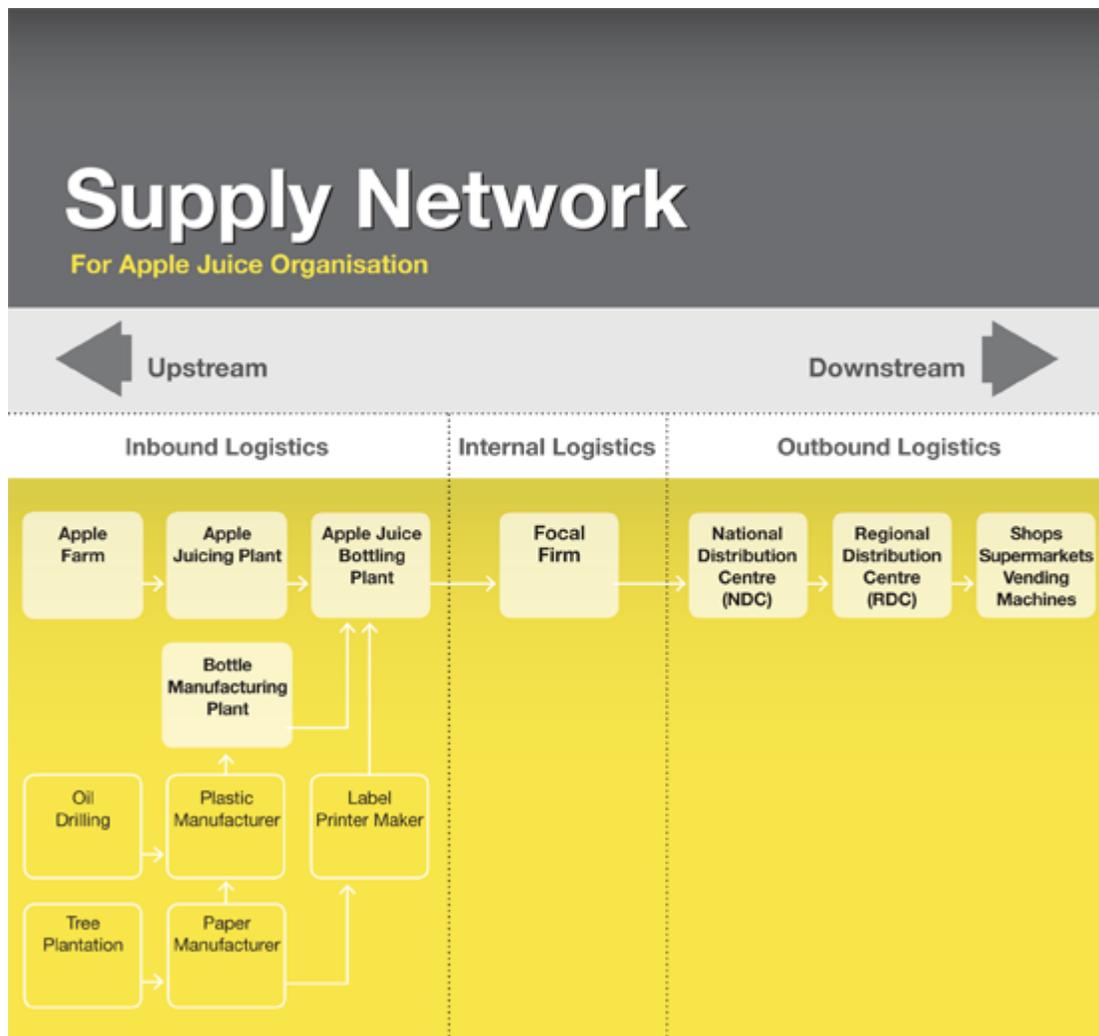
In order to understand a supply chain network; we need to understand what a supply chain is. A supply chain is a series of processes linked together to form a chain.

Supply Chain Example: for apple juice production.



The above diagram is an example of a simplified supply chain; the supply chain shows the movement of material flow from the Apple farm right through the production process to the end users.

Supply Chain Network Example: For Apple Juice Organisation



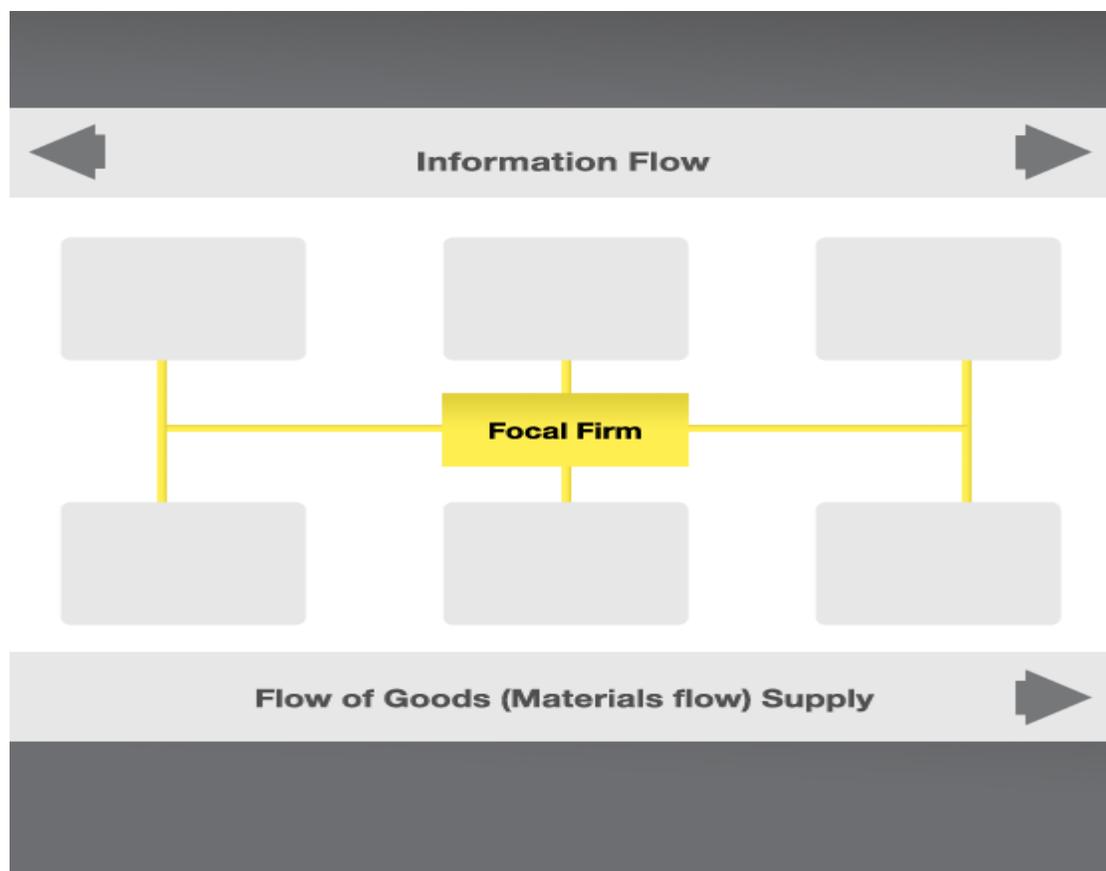
A supply chain network shows the links between organisations and how information and materials flow between these links. The more detailed the supply chain network the more complex and web like the network becomes.

The above example demonstrates a simplified version of a supply chain network of an Apple Juice organisation. The organisation will have an upstream network and a downstream network.

Organisations are linked via two types of flows:

To get a complete picture of an organisations supply chain network; information & material flow should be mapped. Inefficiency can then be located and removed.

- **Material flow:** Is the movement of goods from raw primary goods (such as Wool, Trees and Coal etc.) to complete goods (TV's, Radios and Computers) that are to be delivered to the final customer.
- **Information flow:** Is the demand from the end-customer to preceding organisations in the network.
- **Supply Chain Network: Information flow, Flow of Materials**



- If a focal firm provides their suppliers with their sales data/ forecasting demand information; their supplier will be able to reduce costs (such as over production waste) and improve prices

- In order to better serve your end customer it is important to develop strong partnerships within your supply network which has a flow on effect to your end customers whether you are a manufacturer, distributor or retailer. Better communication will increase efficiency and productivity. Trust is the core ingredient to developing better communication and relationships.

2.4 Inter-related factors in Network

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. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.

Another definition is provided by the *APICS Dictionary*, when it defines SCM as the "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally. "

Supply chain management must address the following problems:

Distribution network configuration: number, location and network missions of suppliers, production facilities, distribution centers, warehouses, cross-docks and customers.

Distribution strategy: questions of operating control (centralized, decentralized or shared); delivery scheme (e.g., direct shipment, pool point shipping, or cross docking), DSD (direct store delivery), closed loop shipping; mode of transportation (e.g., motor carrier, including truckload, LTL, or

parcel); railroad; intermodal transport, including TOFC (trailer on flatcar), and COFC (container on flatcar); ocean freight; airfreight; replenishment strategy (e.g., pull, push or hybrid); and transportation control (e.g., owner-operated, private carrier, common carrier, contract carrier, or 3PL).

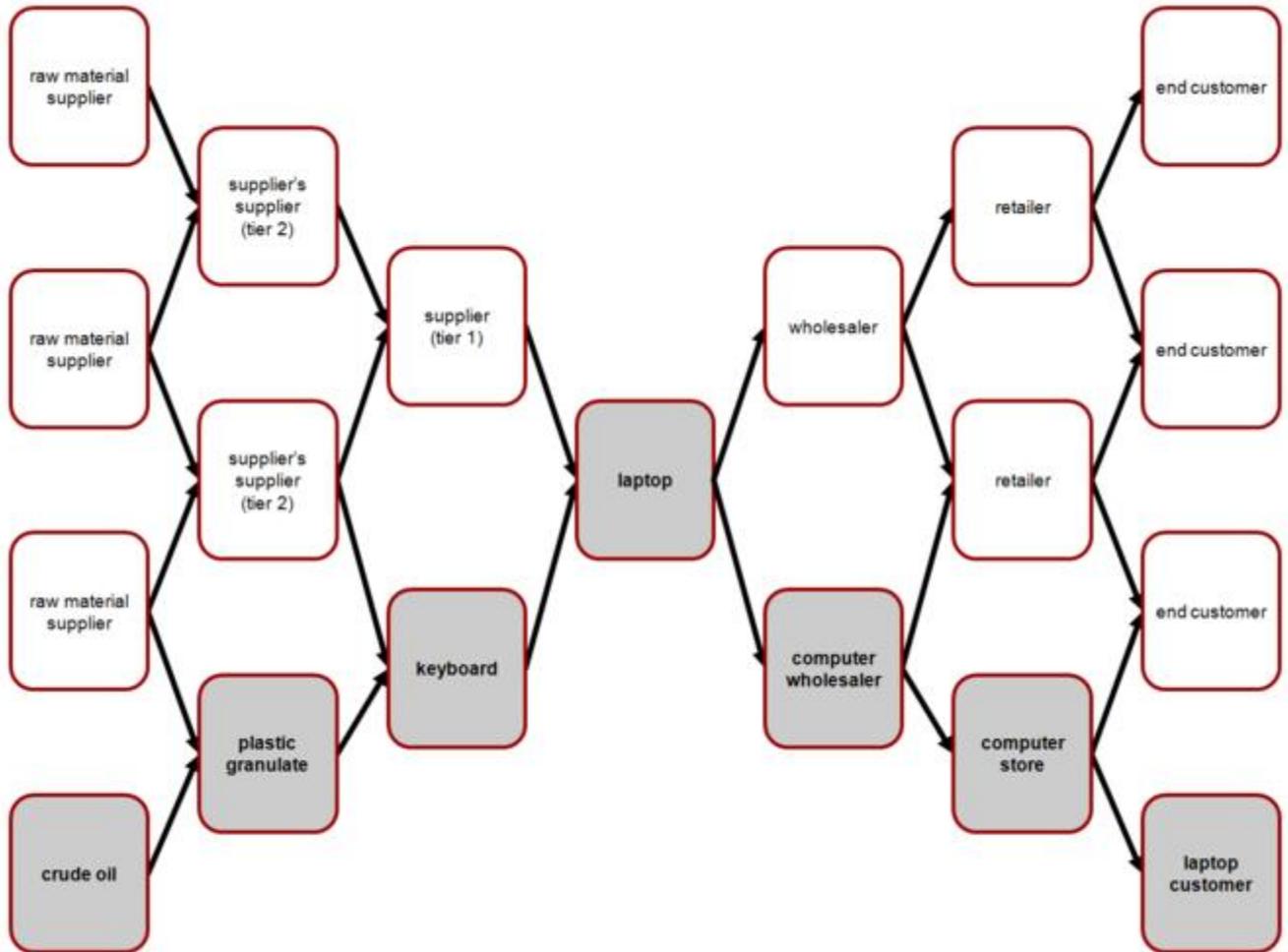
Trade-offs in logistical activities: The above activities must be well coordinated in order to achieve the lowest total logistics cost. Trade-offs may increase the total cost if only one of the activities is optimized. For example, full truckload (FTL) rates are more economical on a cost per pallet basis than less than truckload (LTL) shipments. If, however, a full truckload of a product is ordered to reduce transportation costs, there will be an increase in inventory holding costs, which may increase total logistics costs. It is, therefore, imperative to take a systems approach when planning logistical activities. These tradeoffs are key to developing the most efficient and effective Logistics and SCM strategy.

Information: Integration of processes through the supply chain to share valuable information, including demand signals, forecasts, inventory, transportation, potential collaboration, etc.

Inventory management: Quantity and location of inventory, including raw materials, work-in-process (WIP), and finished goods.

Cash-flow: Arranging the payment terms and methodologies for exchanging funds across entities within the supply chain.

Supply chain execution means managing and coordinating the movement of materials, information, and funds across the supply chain. The flow is bi-directional.



2.5 Network Optimization

The increasing complexity is exactly why supply chain networks need to be frequently re-evaluated. It encompasses planning and management of all activities involved in sourcing, production, warehousing and distribution of products. A world class supply chain network is essential for product to consistently flow from the point of manufacture to the end user. A well-designed supply chain network can significantly improve margins, support expansion into new markets, enhance the customer experience, and reduce operating costs.

Three critical elements to a world class supply chain network are:

1. **Strategy Before Network** - With complex and competing business goals—such as minimizing capital, improving operating margins, lowering the carbon footprint, and enhancing the customer experience—a clear and concise supply chain strategy must be fully aligned with your business strategy. Surprisingly, many companies begin reducing network costs before they define how the network can be fully leveraged to support the business strategy. Uncertainty in product mix and volumes, expanding markets, margin goals, dynamic customer service strategies, value-added opportunities, and product returns and obsolescence are just some of the considerations that are often given minimal consideration or overlooked entirely.
2. **Focus on Total Profit Optimization** - An increasing number of companies are asking the question: “How can my supply chain be used to maximize profits?” This is a different objective than traditional network optimization projects, which define the objective as reducing costs and maintaining customer service levels. Currently, a combination of operating scenarios are required that drive alternative network models. Then sensitivity analysis is performed to evaluate impacts on how a company is working to improve the parameters it uses to drive shareholder value. Some examples include: EBIDTA, capital employed, working capital, operating expenses, tax effectiveness, margins, and cash-to-cash conversion.
3. **Project Versus Ongoing Process** - World class supply chain networks evolve as sourcing adapts to market changes, product line performance varies, and companies integrate. A world class network incorporates an ongoing process that focuses on the flexibility of the supply chain and ensures that objectives are met consistently and over a range of market conditions while enhancing the key drivers of shareholder value.

Companies have realized the importance of supply chain network design exercises but are still unable to make the best use of it. The challenge typically lies in selecting the right approach. Internal factors driving supply chain network design are focused on driving service delivery and working capital optimization across existing networks.

As an example, inventory optimization exercises across the supply chain network focus on getting the inventory strategy right at each node of the supply chain using a customer-centric approach.

Companies have invested in processes, tools and resources to achieve efficiency and effectiveness through their supply chains. Many of them have migrated to an integrated planning approach with the objective of increased service level, responsiveness and on-time full delivery while judiciously balancing working capital needs. However such integrated planning often starts with an assumption that supply chain networks are static and tend towards driving optimization around the same. Since supply chains themselves are dynamic, supply chain network design exercises attempt to make supply chains agile enough to address current changes and future uncertainties.

Supply chain decisions typically are taken at three levels: strategic, tactical and operational. At the strategic level, decisions typically link to business strategy and involve high investments, high change-over lead times and longer horizons. At the tactical level companies focus on adopting measures that focus on competitive needs, such as moving to a target cost structure for servicing certain markets. At the operational level the major focus is operational efficiency. Decisions are typically made on a day-to-day basis under the framework defined at strategic and tactical levels.

Supply chain network design is a powerful modeling approach proven to deliver significant reduction in supply chain costs and improvements in service levels by better aligning supply chain strategies. It incorporates end-to-end supply chain cost, including purchase, production, warehousing, inventory and transportation. While this is considered a strategic supply chain planning initiative, organizations can gain competitive advantage by running supply chain network scenarios, evaluating and proactively implementing changes in response to dynamic business scenarios like new product introduction, changes in demand pattern, and new supply sources.

When kicking off a network analysis, team members often forget that one of the most important tasks is communication. Without communication, a plunge into the retrieval of information and direction to perform a network analysis will surely experience gaps and intensive rework. The second task is to re-establish the scope of the project, taking into account any changes that have occurred to that scope. A third is to establish an executive strategies workshop. This should be a formal meeting in which the business leaders agree to the primary drivers and direction of the company.

Next, the team must document the existing network. It is critical to collect information from all sites being considered because the study could result in recommendations for closing, moving, or expanding them. Visiting those sites can be insightful. The following information needs to be collected for each site:

- Space utilization,
- Layout and equipment,
- Warehouse operating procedures,
- Staffing levels,
- Receiving and shipping volumes,
- Building characteristics,
- Access to location,
- Annual operating cost,
- Inventory, and
- Performance reporting.

In addition to facility information, the following information should be collected for the transportation system:

- Freight classes and discounts,
- Transportation operating procedures,
- Delivery requirements, and
- Replenishment weight/cube.

Most business units within an organization are impacted by a network optimization. Therefore, senior leadership must understand and support which direction the project will take in order for it to be successful. This is where a clear definition of project scope becomes critical. Prior to the project, the leadership team agrees to an overall business direction for the following categories:

- **Sales** – What direction is the company taking to increase sales? (Global expansion, acquisition, e-commerce, same store sales, etc.) Is marketing willing to reduce inventory to see the impact to customer service levels?
- **Timeline** – What is the desired recommendation date? This is tricky since it can result in a push to meet a date versus providing the best overall recommendations.
- **Marketing** – Are there changes in the business that will create a metamorphosis of product distribution, such as Internet daily promotions vs. bi-weekly store level promotions? Is marketing willing to reduce inventory if there is an impact to customer service levels?
- **Production** – Does production understand the impact of optimal manufacturing batches to inventory to locations?
- **Finance** – How critical is cash flow and the impacts to major investment?
- **IT** – Are there systems in place to give the necessary information for the analysis to be conducted properly? If not, agree to understanding the recommended approach from the support teams.
- **Sensitivity Metrics** – This is a great time for the leadership team to identify metrics that should be considered for sensitivity analysis. This can include but not be limited to fuel costs, service time, planning horizon, and capital investment.
- **Internal vs. External** – Who should perform this analysis? Senior leadership must decide if it makes sense to perform the project in-house or to use an outside resource.

At the end of the data collection, a project team meeting is held to summarize the data collected and assess each site. This assessment will give the team insight into

the operation and costs of the existing network. In addition, it will reveal information unknown to management that will be useful in developing alternatives. It is important to analyze and validate baseline information against information available from alternate and independent sources within the company. It is not uncommon for databases or database inquiries to yield incomplete results that would potentially skew the analysis.

Once the leadership team understands the components of its network, and has defined the scope of a project, and elects to do a network evaluation, the team responsible for the execution of the plan should begin the primary data collection for the modeling effort. It is not necessary to have everything prior to solicitations, but generally most reputable consultants will need the following information:

- Growth by organizational tier–formularized
- Sourcing locations and flow by SKU (Stock Keeping Unit)
- Outbound Flow by SKU to customer
- Trans-shipment movements between facilities
- DC cost metrics
- Outbound distribution\fulfillment costs (fixed vs. variable)
- Facility characteristics (size, staff, lease/own, drawings, equipment within, capacities
- Fleet characteristics(Internal vs. external)
- Published costs metrics (case/cube/lb)
- General Ledger accounts for the businesses units involved
- SKU listing
- Inventory by SKU location
- Expected start date and requested completion no later than date (three or four required alternatives)

Many times, this becomes a very challenging step. An organization must understand that evaluations require significant resources that recognize a sense of urgency but also a need to ensure that the information collected is accurate. There

are costs and impacts to the accuracy of the network analysis if the beginning information is in poor condition.

Regardless of which modeling method is used, the overall approach should closely resemble the following steps:

- Validate the existing network. Run a computer model to simulate the existing cost. Compare this cost with actual cost.
- Run alternative networks. Once the model is validated, run alternative networks for present volumes and forecasted volumes.
- Summarize runs and rank. Create a table to summarize costs by alternative. The table should list individual distribution center costs.
- Summarize all annual costs and service factors. Create a table that shows, by alternative, all cost and service factors.
- Perform a sensitivity analysis. This is based on the idea of setting up runs that fluctuate some components of the data. One might be a cost that is uncertain or has potential to change. By modifying this one parameter, the effect on the run can be determined.
- Determine all investment costs associated with each alternative. Look, for instance, at the costs of new warehouse equipment required to save space, expansion, and construction costs, or at any building modifications such as adding dock doors.

A good supply chain network plan relies on a defined set of requirements. It should not be composed simply of ideas, thoughts, or possibilities. Possible requirements should be defined, analyzed, evaluated, and validated. They should result in the development of a specific set of strategic requirements. Normally, the planning horizon for such a plan is stated in years, with a five year plan being the most typical. An effective network plan is also action-oriented and time-phased. Where possible, the plan should set forth very specific actions needed to meet requirements, rather than simply state the alternative actions available. Future sales

volumes, inventory levels, transportation costs, and warehousing costs all come into play.

To get company leadership's support for the plan, a detailed written document and maps should accompany the recommended action to describe and illustrate how the network will be implemented and how it will operate. The result should illustrate which strategy is best for the company because it maximizes profits to stakeholders.

2.6 Let's sum-up

While there are no clear answers to determine the frequency of such an exercise, it is important that companies review their key metrics and goals against existing supply chain networks periodically. Demand environment and supply side capabilities are not static, and doing an annual review on key operating needs like inventory needs, cost to serve channels/outlets, etc. is a good idea. In the eventuality of external triggers, the team needs to carry out preparatory exercises well in advance to accommodate long-term decisions and their lead time to implement.

Supply chain network design with a powerful modeling approach can deliver significant reduction in supply chain cost and improvements in service levels. It incorporates end-to-end supply chain cost: purchasing, production, warehousing, inventory and transportation. Companies can revisit their network periodically, considering changes in business scenarios like new product introduction, changes in demand pattern, regulatory changes and new supply sources so as to better align supply chain networks.

2.7 Key Terms

Work in process

Work in process (acronym: WIP) or in-process inventory includes the set at large of unfinished items for products in a production process.

Raw materials

A raw material is the basic material from which a good product is manufactured or made, frequently used with an extended meaning.

Finished goods

Goods that are completed as to manufacturing but not yet sold or distributed to the end-user.

Value Delivery Network

Value delivery network is a part of supply chain of a company and includes all its direct participants involved in production, distribution, marketing, customer service, etc. for given geographical area.

It a chain of system where after each system more a more value is added to the product or services thereby increasing its overall value for the customer.

Each system is partnering with other system to provide better value to the customer. Production system uses feedback sales history to produce the right product in required quantity. The value created through such partnering depends upon the quality of relationship between the systems.

E.g.: Companies like Fiat have improved its position in North America by partnering with Chrysler to improve its delivery network. This has helped Fiat gain vital market share in highly competitive market with very low investment.

Stock Keeping Unit (SKU)

In the field of inventory management. A stock keeping unit is a distinct type of item for sale, such as a product or service and all attributes associated with the item type that distinguish it from other item types. A SKU is used to track

inventory in a retail store. They are very valuable in helping to maintain a profitable retail business.

Value added network

It is a private network used to exchange electronic data and network services. Prior to the inception of the internet companies used high value networks to transfer their data to other companies and paying monthly charges for them.

They were also given secure Id's, encrypted data and EDI's. It is a type of mail where information is retrieved from the network by the receiver and replied through the network. However the text used is standardized or formatted which differentiates it from an email.

2.8 Self-assessment Questions

1. Give examples of cost associated with
 - a. Purchasing
 - b. Transportation
 - c. Warehousing
 - d. Production
 - e. In-house handling
2. Discuss reshoring.

2.9 Further Readings

- Alan Harrison, Remko V Hoek (2011) Logistics Management and Strategy, 4th edn, Pearson
- Slack, N, Chambers S. Harland, C., Harrison, A. and Johnston, R. (1997) Operations Management, 2nd edn, Harlow: Ft/Prentice Hall

- Supply Chain Management: Relationships, Chains and Networks

Authors- C. M. Harland, First published: December 1996 in British Journal of Management

2.10 Model Questions

1. What is supply chain integration? Discuss with example.

Ans: Supply chain integration is a close alignment and coordination within a supply chain, often with the use of shared management information systems. A supply chain is made up of all parties involved in fulfilling a purchase, including raw materials, manufacturing the product, transporting completed items and supporting services.

Supply chain refers to all inputs required to produce a product and fulfill a purchase. For example, a company that assembles computers would need to purchase components such as circuit boards. The circuit board company would need to purchase materials to produce them, including wire and silicon. All of these materials and components form part of the company's supply chain of materials needed to produce the end result of a working computer. Once the computer is built, a trucking company may take it to a wholesaler warehouse, and then it may be delivered to a retail store for sale or shipped directly to an end user. Every step - from sourcing of raw materials to final delivery to the customer - is considered part of the supply chain of the computer.

2. How do companies integrate supply chain?

Ans: There are several different levels of supply chain integration. Generally, the first step in integration would be to select specific vendors to provide specific inputs, and develop an agreement for them to provide a set amount of inputs during the year at a set cost. This ensures the company has the materials it needs to produce its expected output of computers during the year. Our

computer company might sign a contract with a large supplier of circuit boards, for example, that requires it to deliver a specific quantity at specific times during the year and sets a price that will be in effect during the contract.

A higher level would be to integrate the companies more closely. The circuit board provider might build a plant close to our assembly plant, and we might share production software so the circuit board company can see how many boards we'll need in the upcoming week and can build them as we need them to meet sales demand.

An even higher level is called vertical integration, which is when the supply chain of a company is actually owned by the company. For example, our computer company could purchase a circuit board company in order to ensure a dedicated supply of components.

3. What are the advantages of supply chain integration?

Ans: Some of the most important advantages to having an integrated supply chain:

1. Stay on top of demand

With integrated logistics, supply chain and product innovation strategies, companies are better positioned to predict demand and act accordingly. Today's increasingly global supply chain needs to be able to spin on a dime and accommodate shorter product life cycles, emerging markets and fluctuating economies. Marrying innovation with logistics and effective supply chain management is one way to make sure businesses are adequately responding to changes in demand.

2. Flexibility

One of the most important benefits of an integrated supply chain is increased flexibility. Houston Chronicle contributor Chirantan Basu noted that by integrating all of a business's functions, flexibility can be achieved.

“Tight supply chain integration gives management operational flexibility to respond rapidly to external events, such as the actions of competitors and changes in customer demand,” Basu wrote. “Companies can gather intelligence through their supply chains, which allows them to be generally aware of what their competitors are planning months in advance.”

3. Eliminate waste

Maintaining a sustainable supply chain isn't easy. Supply chain management professor and Inbound Logistics contributor Paul A. Myerson noted that lean practices help identify and eliminate waste in the supply chain, and increased agility allows organizations to respond effectively to unpredictability. So a combination of agile and lean supply chain practices is the best option. Integrating data from across operations is the best way to ensure that the supply chain is sustainable and successful in the long term.

4. Higher profit margins

The previous three benefits lead into this one: When the supply chain is a well-oiled machine, it's easier for companies to maintain and even increase their revenue, resulting in higher profit margins. Effectively managing an innovative, collaborative supply chain – through the use of product and portfolio management software and SCM solutions – can help businesses produce and deliver products at a much faster, more successful rate, and thus attain that higher profit margin.