Supply Chain Management

by

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Supply Chain Management

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Supplier Selection and Contract Negotiation

Creating a world class supply base

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World Wide Sourcing

Supply Chain Management

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Strategic Sourcing Outsourcing

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World Wide Sourcing

Definition: Supply Chain Management:

The supply chain encompasses all activities involved in the **transformation of goods** from the **raw material stage to the final stage**, when the **goods and services** reach the end customer.

Supply chain management involves **planning, design and control of flow of material**, **information and finance** along the supply chain to **deliver superior value** to the end customer in an **effective and efficient manner**.

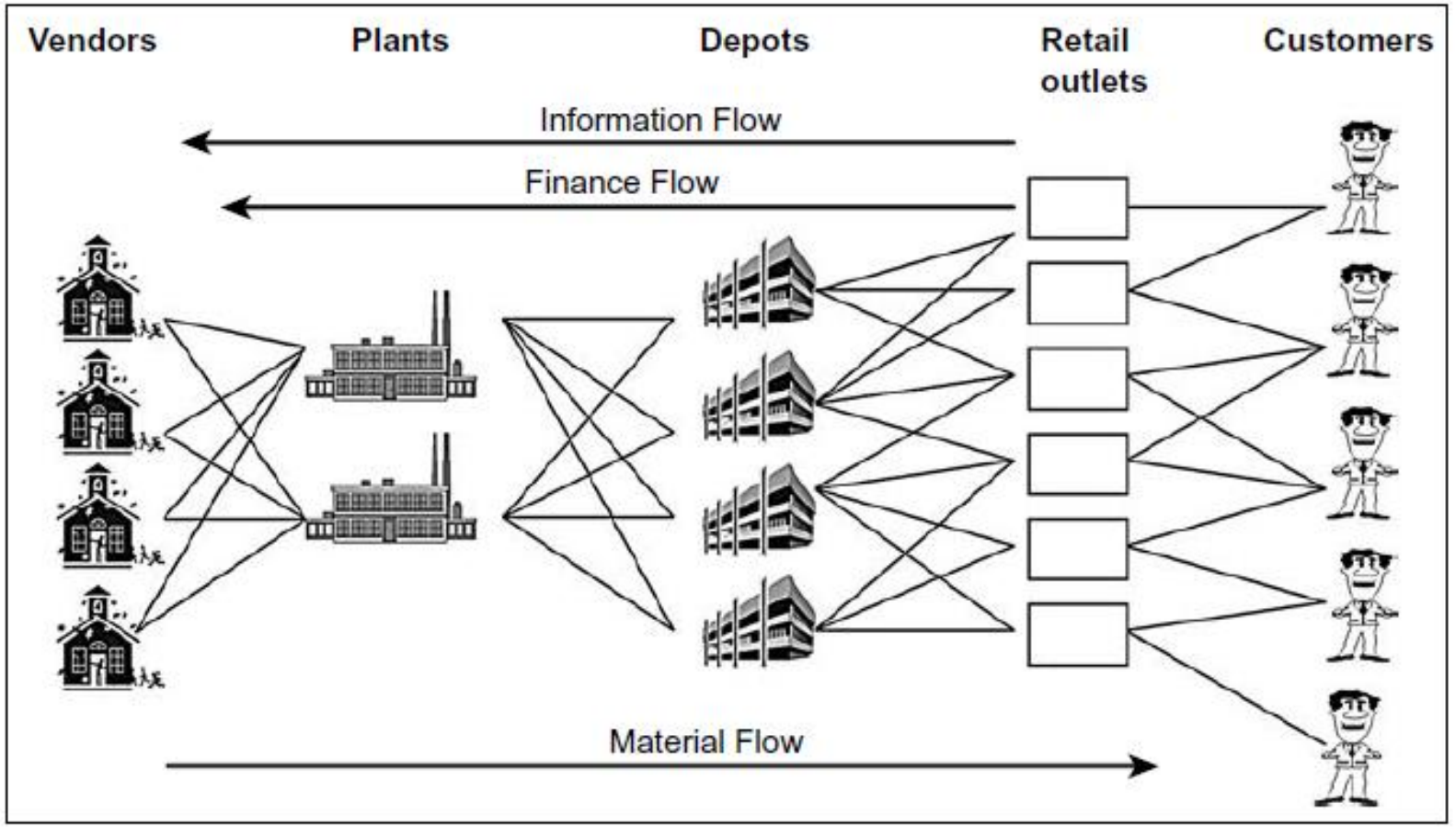


Figure: A supply chain network.

Definition: Supply Chain Management:

From Figure: supply chain not only includes **manufacturers, suppliers and distributors** but also transporters, warehouses and customers themselves.

Example of **Hindustan Unilever (HUL) versus Procter & Gamble (P&G)**

Supply chains of both these firms compete against each other. The customer is interested only in the **price, availability and quality of the product** at the neighborhood **retail outlet**, where they actually come into contact with products supplied by HUL and P&G.

If customers observe **inefficiency on account of non-availability, damaged packaging**, etc. at the retail end with regard to **HUL's products**, they attribute inefficiency to HUL and not **to its chain partners.** The customer is only interested in getting the **desired product** at the right **place, at the right time and at the right price**.

For a **simple product** like soap, the HUL supply chain involves **ingredient suppliers, transporters, the company's manufacturing plants, carrying and forwarding agents, wholesalers, distributors and retailers**.

Obviously, HUL does not own all these entities, but the **HUL brand name is at stake** and it has to be ensured that **the entire chain delivers value to the end customer**. HUL cannot afford to focus only **on those parts of the chain that are owned by it** and ignore the other parts of chain.

Definition: Supply Chain Management:

The supply chains of **automobile companies** (Maruti, Tata Motors and TVS) and other companies like **BPL, LG and Whirlpool**, dealing in consumer durables, will be very similar to the one depicted in Figure 1.1.

On the other hand, companies in the consumer **non-durables business**—for example, **HUL, P&G, Godrej Soaps and Nestlé**—have to work with supply chains that are likely to be **much longer and more complex**. The term ***chain* is a little misleading** because it gives the impression that there is **only one entity at each stage of the supply chain**.

In reality, as seen in Figure 1.1, **multiple entities** are involved at each stage: a manufacturer receives **material from several suppliers** and, in turn, **distributes the products through multiple distributors**. The more appropriate term probably will be either ***supply networks* or *supply web*.**

Single Chain

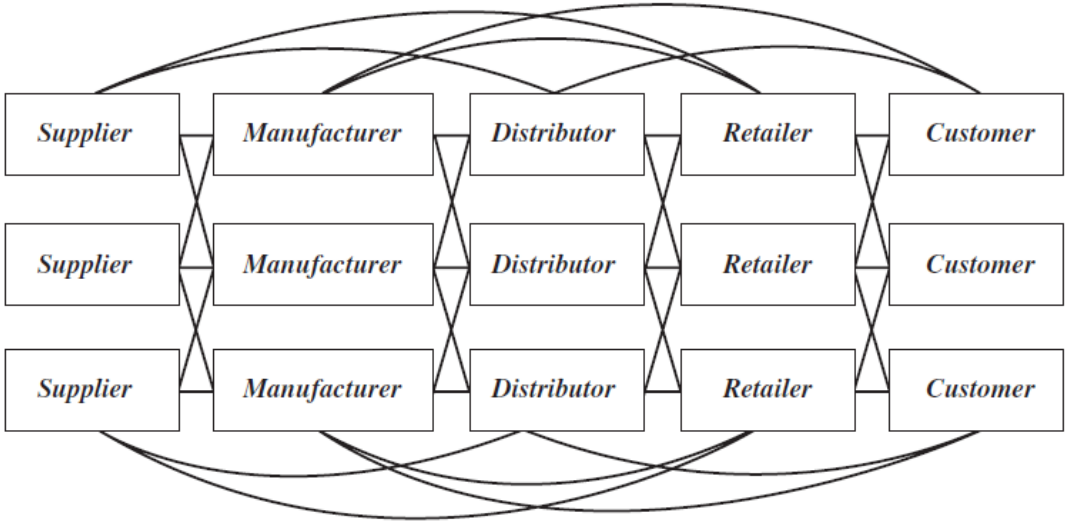


FIGURE 1-2 Supply Chain Stages

Supply Chain Management: Goals

Important goals of supply chain management:

 Supply chain partners work collaboratively at different levels to maximize resource productivity, construct standardized processes, remove duplicate efforts and minimize inventory levels.

 Minimization of supply chain expenses is **very essential**, especially when there are **economic uncertainties** in companies regarding their wish to conserve capital.

 Cost efficient and cheap products are necessary, but supply chain managers need to concentrate on value creation for their customers.

 Exceeding the **customers' expectations** on a regular basis is the best way to satisfy them.

 Increased cost c**expectations of clients** for higher product variety, customized goods, off-season availability of inventory and rapid fulfillment at a omparable to in-store offerings should be matched.

 To meet consumer expectations, merchants need to leverage inventory as a shared resource and utilize the distributed order management technology to complete orders from the optimal node in the supply chain.

Supply Chain Management: Advantages

The **key benefits of supply chain management** are as follows:

- Develops better customer relationship and service.
- Creates better delivery mechanisms for products and services in demand with minimum delay.
- Improvises productivity and business functions.
- Minimizes warehouse and transportation costs.
- Minimizes direct and indirect costs.
- Assists in achieving shipping of right products to the right place at the right time.
- Enhances inventory management, supporting the successful execution of just-in-time stock models.
- Assists companies in adapting to the challenges of globalization, economic upheaval, expanding consumer expectations, and related differences.
- Assists companies in minimizing waste, driving out costs, and achieving efficiencies throughout the supply chain process.

Supply Chain Performance Measures

The **Supply-Chain Council** is an independent, **non-profit, global corporation** interested in getting the **industry to standardize** supply chain terms so that meaningful **supply chain benchmarking** can be carried out.

Supply Chain Operations Reference (SCOR) model as the **industry standard** for supply chain management.
Several supply chain **software vendors** have adopted the **SCOR performance measures** in their **performance management module**.

SCOR recognizes **six major processes**: *Plan, Source, Make, Delivery, Return, and Enable.*

As per the **SCOR model**, supply chain performance measures fall under the following **five broad categories.**

1. Cost
2. Assets (Asset Management Efficiency)
3. Reliability
4. Responsiveness
5. Agility

Supply Chain Performance Measures

Supply-Chain Council refers to measures related to **costs, agility and assets** as **internal-facing** measures, while **reliability and responsiveness** are termed as **customer-facing** measures.

Firm offers a bundle consisting of **price, delivery and flexibility** to its **customers**

SCOR Model Supply chain metrics	Customer facing		Internal facing		
	Reliability	Responsiveness	Agility	Cost	Assets
Perfect order fulfillment	•				
Order fulfillment cycle time		•			
Upside flexibility			•		
Upside adaptability			•		
Downside adaptability			•		
Overall value-at-risk			•		
Total cost to serve				•	
Cash-to-cash cycle time					•
Return on fixed assets					•
Return on working capital					•

Supply Chain Performance Measures

Price, in competitive markets, is dictated by the **market place**.

Thus, only **delivery**- and **response**-related measures are termed as **customer-facing measures**.

The performance measures related to **assets and costs** affect the **profitability** of the firm and are, thus, termed as **internal-facing measures**.

The use of **standard measures** allows **firms** to carry out meaningful **benchmarking studies**.

Benchmarking studies carried out by the **Supply-Chain Council** have shown that there are **significant differences** in performance across firms in various industries

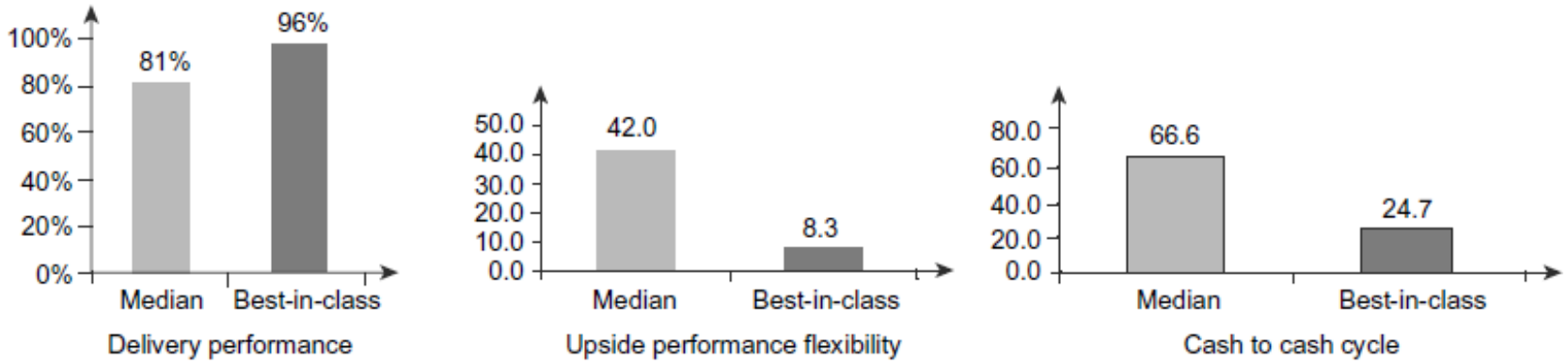
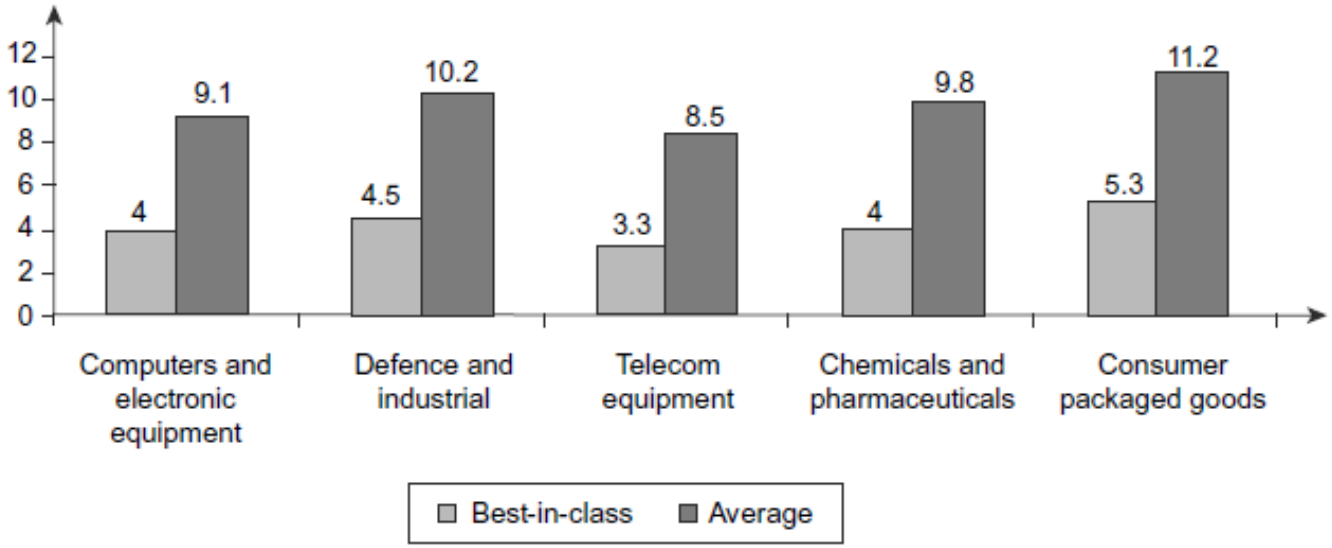


Figure explains the performance of supply chain costs as a percentage of revenue for various industries

The **best in the class** firms seem to work with substantially **lower supply chain costs** (difference of about 5–6 per cent of revenue) across industries.

Supply Chain Performance Measures

Best in class firms also seem to have substantial differences in **performance measures** of **reliability, assets and flexibility**, as shown in Figure (Comparative performances for consumer package goods)



Such significant differences in performance also mean that firms seem to follow a wide variety of processes and systems

Supply Chain Performance Measures

Benchmarking Supply Chain Performance Using Financial Data

Following three performance measures:

Total length of the chain. The total length of the chain is arrived at by **adding** up the **days of inventory for raw materials, work in progress and finished goods**. The firm that has the **minimum total length** of the chain is said to have the best performance.

DRM, *DWIP*, *DFG* = Days of raw material, work in process and finished goods, respectively

$$\boldsymbol{DRM} = RM \times 365/CRM$$

Table 2.2: Terms directly obtained from the financial statements.

Terms from the income and expenditure statement	Symbol	Terms from the balance sheet	Symbol
Cost of raw materials*	*CRM*	Inventories (inclusive of raw materials, semi-finished goods and finished goods)	*INV*
Cost of production*	*CP*	Raw materials inventory	*RM*
Cost of distribution*	*DC*	Semi-finished goods inventory	*SFG*
Cost of sales*	*CS*	Finished goods inventory	*FG*
Net sales*	*NS*	Account receivables (excluding loans and advances)	*AR*
		Account payables	*AP*

$$\boldsymbol{DWIP} = SFG \times 365/CP,$$

$$\boldsymbol{DFG} = FG \times 365/CS$$

Total length of chain in days = *DRM + DWIP + DFG*

Supply Chain Performance Measures

Benchmarking Supply Chain Performance Using Financial Data

Supply chain inefficiency ratio. This ratio measures the relative efficiency of internal supply chain management. The ratio will be **low** for the firms with **better performance**.

$SCC = DC + INV \times ICC$ and
$SCI = SCC/NS$

SCC is the supply chain management costs,
ICC is the inventory carrying cost and
SCI is the supply chain inefficiency ratio.

The inventory carrying cost for most firms is estimated to be in the range of **0.15–0.25**

Supply chain working capital productivity. The analysis of firms on this metric will also be based on the levels of **inventory, accounts receivable and accounts payable**.

Firms with efficient **supply chains** will usually have **high supply chain working capital productivity.**

The supply chain working capital productivity is calculated using the following formula:
$SWC = INV + AR - AP$; where *SWC* is the supply chain working capital.
$SWCP = NS/SWC$; where *SWCP* is the supply chain working capital productivity.

Importance of the Supply Chain

In the past, **customers** were **not very demanding and competition** was **not really intense**. As a result, firms could afford to **ignore issues** pertaining to the **supply chain**.

Today, firms that **do not manage their supply chain** will incur **huge inventory costs** and eventually end up **losing a lot of customers** because the **right products** are **not available at the right place and time.**

The following are the **five major trends that have emerged** to make supply chain management a critical success factor in most industries.

1. Proliferation in product lines

Companies have realized that **more and more product variety** is needed to satisfy the growing range of **customer tastes and requirements**.

For example: Every time a customer walks into a neighborhood store, he or she is bound to discover a **couple of items on the shelf that** he or she had not seen during his or her **last visit** and that he or she has **more varieties to choose from now**.

Every time you walk into a neighborhood store, do not be surprised to find that even a simple product like **toilet soap has 50-odd varieties**.

Importance of the Supply Chain

2. Shorter product life cycles

With increased competition, product life cycles across all industries are becoming shorter.

For example, technology leaders like **Apple** works with a life cycle as short as **6 months**. So a **firm like *Apple***, which has, on an average, just **5 days of inventory**, as compared to the **industry average of 35 days**, does not have to **worry about product and component obsolescence.**

Its competitors with **higher inventories end up writing off huge amounts of stocks** every **year as obsolete.**

Most of the technology firms find that **50 per cent** of their **revenue** comes from **products** that were introduced in the **last three years.**

3. Higher level of outsourcing.

"Evolution of Supply Chain Management", firms increasingly **focus on their core activities** and **outsource non-core activities** to other competent players.

For Example: Bharti Tele-Ventures, India's number one private telecom service provider, has **outsourced network-management services, IT services and call centre** operations.

Importance of the Supply Chain

4. Shift in power structure in the chain

In **every industry**, the **entities closer to customers** are becoming more **powerful**. With increasing competition, a **steadily rising number of products** are chasing the same **retail shelf space**. Retail shelf space has **not increased at the pace** at which **product variety** has increased. So there have been **cases of retailers asking for slotting allowance** when manufacturers **introduce new products in the market place**.

Some firms have started talking about trade **marketing and treating dealers and retailers as their customers** while simultaneously trying to woo the **retailers aggressively**. There is a clear **shift in the power structure.**

In general, manufacturers are forced to respond more quickly to the customers' demands, because of changes in the power structure within the chain.

5. Globalization of manufacturing.

Over the past decade, tariff levels have come down significantly. Many companies are **restructuring their production facilities** to be at **par with global standards**.

For example, companies like **ABB** have developed some **global centres of excellence** for **each of their product lines** that take care of the **global market**.

Importance of the Supply Chain

5. Globalization of manufacturing.

For example,

General Motors is talking about a **world car** and has been **designing a few cars** for global markets.

In the **telecommunications and electronics industry**, companies usually get their **chips** from **Taiwan**, **test** them in **Europe** and finally **integrate them** with **other products** in the **United States of America** to sell in the **international market**.

Evolution of the Supply Chain

Evolution of supply chain management has been a **gradual process.**

Over the last century, there have been **three major revolutions** in the field of **supply chain management** and we examine each of them in the context of the **broader evolution** in the **economic and technological environment**.

According to **Henry Ford** in **1910**, a well-integrated supply chain in place that allowed it to **minimize cost and maximize asset productivity.**

Most people, including students and business executives, are surprised to learn that the company that achieved this, did so almost a century ago.

Thereby, it is interesting to know evolution of supply chain evolved over the past century.

First Revolution (1910–1920): Vertical integrated firms offering low variety of products

Ford Motor Company where they had managed to build a tightly integrated chain.

The **Ford Motor Company** owned every part of the chain— right from the **timber to the rails**. Through its tightly integrated chain, it could manage the journey from **the iron ore mine to the finished automobile in 81 hours**.

Evolution of the Supply Chain

However, as the famous saying goes, the **Ford supply chain** would offer **any colour**, as long as it was **black**; and any model, as long as it was **Model T**.

Ford innovated and managed to build a **highly efficient**, but **inflexible supply chain** that could not handle a **wide product variety** and **was not sustainable in the long run**.

General Motors, on the other hand, understood the **demands** of the **market place** and offered a wider variety in terms of **automobile models and colours**.

Ford's supply chain required a **long time for set-up changes** and, consequently, it had to work with a **very high inventory in the chain**.

Till the **second supply chain revolution**, all the **automobile firms** in **Detroit** were integrated firms. Even traditional firms in India, like **Hindustan Motors**, were highly integrated firms where the bulk of the manufacturing was **done in-house**.

Evolution of the Supply Chain

The Second Revolution (1960–1970): Tightly Integrated Supply Chains Offering Wide Variety of Products

At the end of the **first revolution**, the manufacturing industry saw **many changes**, including **a trend towards a wide product variety**.

To deal with these **changes**, firms had to **restructure their supply chains** to be **flexible and efficient**. The supply chains were required to deal with a ***wider product variety*** without **holding too much inventory**.

The **Toyota Motor Company** successfully addressed **all these concerns**, thereby leading in the second revolution.

Toyota Motor Company came up with **ideas** that allowed the **final assembly and manufacturing of key components** to be **done in-house**.

The **bulk of the components** was sourced from a **large number of suppliers** who were part of the **keiretsu system**. **Keiretsu** refers to a **set of companies** with **interlocking business relationships and shareholdings**.

Toyota Motor Company had **long-term relationships** with all the suppliers. These suppliers were **located very close to the Toyota assembly plants**. Consequently, **set-up times**, which traditionally used to take a **couple of hours**, were **reduced to a couple of minutes**.

Evolution of the Supply Chain

The Second Revolution (1960–1970): Tightly Integrated Supply Chains Offering Wide Variety of Products

This combination of **low set-up times and long-term relationships** with **suppliers** in second revolution became more popular as it focus on **lean production system**.

Toyota and other Japanese firms tried to set up **assembly plants** in different parts of the **world,** they realized that they would have to **take their suppliers** also **along with them**.

Further, they found that some of **the suppliers in keiretsu** had become **self-satisfied** and were **no longer cost competitive**.

With the advent of **electronic data interchange (EDI),** which facilitated electronic exchange of information **between firms,** it was possible for a firm to **integrate with the suppliers without forcing** them to locate their **plants close to the manufacturers' plant**.

Toyota supply chain also had **certain rigidities**, such as a **permanent relation with suppliers**, which could become a **problem over a period of time.**

This, in turn, led to the **third revolution spearheaded** by couple of **progressive companies** like **Dell Computers, Apple Inc**., and **Bharti Airtel**, which offered, its customers the **luxury of customization** with loosely **held supplier networks**.

Evolution of the Supply Chain

The Third Revolution (1995–2020): Virtually Integrated Global Supply Networks Offering Customized Products and Services

Information technology, evolved **faster than enterprises** can find applications for some of the **innovations,** is the **fuel** for the **third revolution in supply chain**

Couple of years wherein, **IT-enabled model** that has emerged and **begin to apply** it to **all industries.**

We will illustrate key characteristics of the **third revolution** using the example of

1. **Dell computers:** Product company
2. **Apple Inc., :** Product and service
3. **Bharti Airtel:** Pure service organization

Dell computers allows **customers** to **configure their own laptops** (in terms of processors, video cards, screen sizes, memory, etc.) and **track the same in their production** and **distribution systems.**

Apple offers personal **digital devices** to its **customers and iPod** is a classic example.

However, it is **not just** about the **product**. Apple allows consumer to have a personalized user experience through the **features and services**. Users can personalize the **music and other media content on their device** through the various **features available on iPod**.

Evolution of the Supply Chain

The Third Revolution (1995–2020): Virtually Integrated Global Supply Networks Offering Customized Products and Services

Bharti Airtel allows services like My Airtel through which customer can have unique personalized experience.

Summary: It is came to know from revolution, how the dynamic markets and rapidly evolving technologies force us to continuously improve our understanding of supply chain concepts.

To be able to apply the key concepts of supply chain management, we must be able to **observe** how they are used in the **context of the business and market scenario**.

With this backdrop in mind, let us look at some of the key supply chain concepts and **understand why it has become such a critical success** factor in **most industries** and how firms find better and **more efficient ways of managing** this crucial aspect of business in today's world.

Enablers/ Drivers of Supply Chain Performance

Managing supply chains is becoming increasingly complex. Despite this, firms have actually managed to reduce their logistics costs.

For example, in a country like the United States of America, logistics costs used to account for 15 per cent of the gross domestic product (GDP) in the 1980s.

Today, because of innovations in technology and management practices, logistics costs account for about 8.5 per cent of their GDP.

Three major enablers that have helped firms and nations in reducing supply chain costs are briefly discussed below.

Improvement in Communication and IT

Emergence of Third-party Logistics Providers

Enhanced Inter-firm Coordination Capabilities

Enablers/ Drivers of Supply Chain Performance

Improvement in Communication and IT

Computing power has become **cheaper and communication costs** too have **come down**. This has helped **firms in** coordinating **global supply chains in a cost-effective** manner.

Advances in **enterprise resource planning (ERP)** systems have helped firms in **automating several business processes** resulting in **seamless information flow** throughout the **company across different functions**.

The way **ERP systems** have changed the nature of **information flow within organization**, **Internet technology** is likely to change the **nature of information flow** in **interfirm transactions.**

In the past, only **large companies** could integrate **with partner firms** using **expensive EDI** technologies. Now, even **small firms** can communicate with **their chain partners** using the **worldwide web** at a fraction of **the earlier cost**.

Companies are realizing that **they can replace physical inventory** by information.

For example, a company with **multiple plants** can work with a **common pool of safety stock of raw materials** and does not need to have **safety stocks for each individual plant**.

Enablers/ Drivers of Supply Chain Performance

Improvement in Communication and IT

Similarly, **order-processing side**, companies can offer **greater customization** as compared to the past because their order-processing system can be designed to h**andle customized orders** and their **manufacturing and distribution system** would allow them to track these customized products in the system.

In the absence of an information system, this would not have been possible at all.

Emergence of Third-party Logistics Providers

Traditionally, many firms have been managing their logistics **activities internally**.

Lately, companies have realized that they need to **focus** their energies on **managing core business activities**, and hence have been exploring the possibility of **outsourcing logistics** activities to **third-party logistics (3PL)** service providers.

In developed countries, almost **90 per cent of the logistics activities** are **outsourced** and are managed by **3PL companies**.

In developed markets, global firms play the role of a **fourth-party logistics (4PL)** company that can integrate the **capabilities, resources and technology** so as to provide comprehensive supply **chain solutions to its customers**.

Enablers/ Drivers of Supply Chain Performance

Emergence of Third-party Logistics Providers

For example, **Toyota** wanted to set up a **manufacturing plant** in **India**, it asked its **logistics** service provider **Mitsui and Co**. to come to India to take care of its **logistics requirements**.

Enhanced Inter-firm Coordination Capabilities

Successful coordination across a **global network** of companies has been a **comparatively new phenomenon** in the **corporate world**.

Many companies, like **Apple, Nike, Benetton, Nintendo, Sun and Toyota**, have successfully managed **complex networks**, played the part of the **strategic center** and, hence, have emerged as **role models to other companies**.

While each company in the network focuses on its **core competencies**, **the strategic centers function as a leading and orchestrating system**. Consequently, supply chains become more efficient and responsive.

However, there have been a **large number of failures also**, where firms within the chain **could not align their interests**, and as a result the network **could not function effectively**, better **understanding and coordination of issues** would greatly help in diffusing the third supply chain revolution **across all industries**.

Decision Phases in Supply Chain Management

Successful **supply chain management** requires **many decisions** relating to the **flow of information, product, and funds**. **Each decision** should be made to **raise the supply chain surplus**. These decisions **fall into three categories** or phases, depending on the **frequency of each decision** and the **time frame** during which **a decision phase** has an impact.

Supply Chain Strategy or Design:

Strategic decisions involve the following critical issues:

- What activities should be carried out by the **nodal firm** and what should be **outsourced?**

- How to **select entities/partners** to **perform outsourced activities** and what should be the nature of the relationship with those entities? Should the relationship be **transactional in nature** or should it be **a long-term partnership**?

- **Decisions pertaining** to the **capacity and location** of the various facilities.

The decisions pertaining to location and capacity are for those facilities that are **owned** by the **nodal firm**. In addition, to **manufacturing locations and capacities**, the firm has also to worry about **locations and capacities for warehouses** (depots). Supply chain design **decisions are made for the long term** (usually a couple of years) and **are very expensive to alter** at short notice.

Decision Phases in Supply Chain Management

Supply Chain Planning:

For decisions **made during this phase**, the time frame considered is a **quarter to a year**. Therefore, the supply chain's **configuration determined** in the **strategic phase is fixed**. This configuration establishes **constraints within which planning** must be done.

The goal of **planning** is to **maximize the supply chain surplus** that can be generated over the **planning horizon** given the constraints established during the **strategic or design phase**.

Companies **start** the **planning phase with a forecast** for the **coming year** (or a comparable time frame) of **demand in different markets.**

Planning includes making **decisions** regarding which **markets will be supplied from which locations**, the **subcontracting of manufacturing**, the **inventory policies to be followed**, and **the timing and size of marketing and price promotions**.

Based on result of the **planning phase**, companies define a set of operating policies that govern short-term operations

Decision Phases in Supply Chain Management

Supply Chain Operation:

Once supply chain design decisions are in place, the **firm has to take decisions** regarding the **management of supply chain operations** for **shorter horizons**. This involves **tactical decisions**, which have a **horizon** of about **three months to a year**; and **operations decisions**, which usually have a horizon ranging from a **day to a month**.

Both tactical and operations decisions involve the following areas:

- Demand forecasting
- Procurement planning and control
- Production planning and control
- Distribution planning and control
- Inventory management
- Transportation management
- Customer order processing
- Relationship management with partners in the chain

Role in Economy in Supply Chain Management

THREE KINDS OF INVENTORY

1. **Cycle Inventory**—Needed to meet product demand between normally scheduled orders
2. **Seasonal Inventory**—Produced and stockpiled in anticipation of future demand
3. **Safety Inventory**—Necessary to compensate for demand uncertainty and order lead times

Economic Order Quantity (EOQ)

The ordering quantity of a product that minimizes both the ordering cost and the carrying cost

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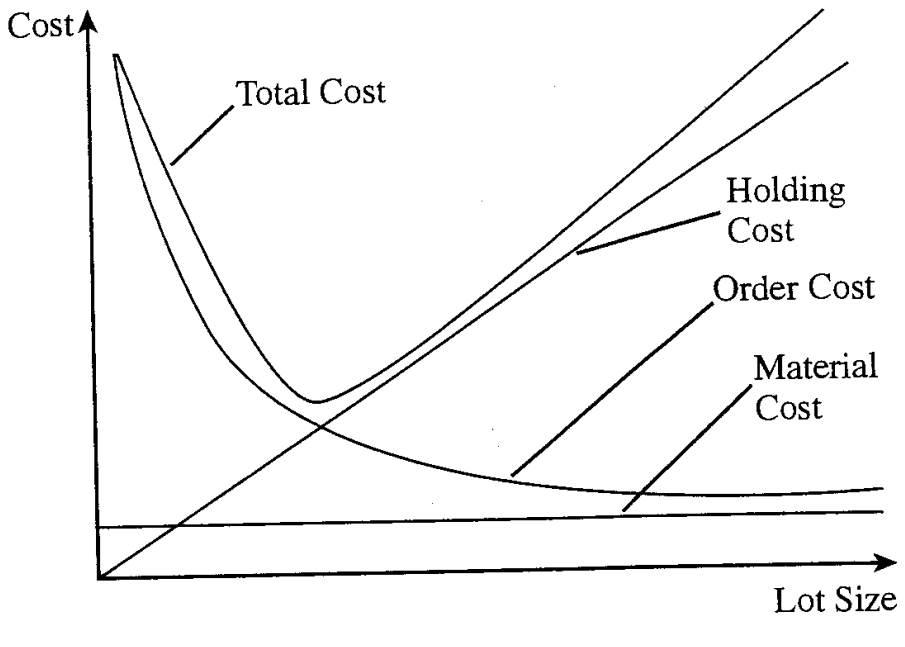

Role in Economy in Supply Chain Management

If the annual usage rate for Item Z is 240, then the monthly usage rate is 20. An EOQ of 34 represents about seven weeks' supply. This may not be a convenient order size. Small changes in the EOQ do not have a big impact on total ordering and holding costs so it is best to round off the EOQ quantity to the nearest standard ordering size. In the case of Item Z, there may be 30 units in a case. So it would make sense to adjust the EOQ for Item Z to 30.

The EOQ formula works to calculate an order quantity that results in the most efficient investment of money in inventory. Efficiency here is defined as the lowest total unit cost for each inventory item. If a certain inventory item has a high usage rate and is expensive, the EOQ formula recommends a low order quantity which results in more orders per year but less money invested in each order. If another inventory item has a low usage rate and is inexpensive, the EOQ formula recommends a high order quantity. This means fewer orders per year but since the unit cost is low, it still results in the most efficient amount of money to invest in that item.

Economic Order Quantity

Given the cost structure of a company, there is an order quantity that is the most cost-effective amount to purchase at a time. This is called the economic order quantity (EOQ) and it is calculated as:

$$EOQ = \sqrt{\frac{2UO}{hC}}$$

where:

U = annual usage rate

O = ordering cost

C = cost per unit

h = holding cost per year as a percentage of unit cost

For instance, let's say that Item Z has an annual usage rate (U) of 240, a fixed cost per order (O) of $5.00, a unit cost (C) of $7.00, and an annual holding cost (h) of 30 percent per unit. If we do the math, it works out as:

$$EOQ = \sqrt{\frac{2 \times 240 \times 5.00}{.30 \times 7.00}}$$

$$EOQ = \sqrt{\frac{2400}{2.1}}$$

$$EOQ = \sqrt{1142.86}$$

EOQ = 33.81 and rounded to the nearest whole unit, it is 34