CHAPTER-1
INTRODUCTION
1.1 MIDC - THE STATE’S INDUSTRIAL CATALYST

The BID (Board of Industrial Development) framed the legislation and it was introduced before the state legislation and passed in the form of "Maharashtra Industrial Act" which gave birth to MIDC, as a separate corporation on August 1, 1962. The BID was the first personnel strength of MIDC.

A small ceremony at Wagle Estate Thane, under the Chairmanship of the Chief Minister Shri Y.B. Chavan, marked the birthday of MIDC on August 1, 1962. The Board of Industrial Development during its existence between October 1, 1960 and August 1, 1962 has done enough spade work to identify the locations for setting up industrial areas in different parts of the state. Thus, right in the first year of establishment MIDC has come up with 14 industrial areas, to initiate action for infrastructure and help entrepreneurs set up the industrial units in those areas.

Maharashtra Industrial Development Corporation is the nodal industrial infrastructure development agency of the Maharashtra Government with the basic objective of setting up Industrial areas with a provision of industrial infrastructure all over the state for planned and systematic industrial development. MIDC is an innovative, professionally managed, and user friendly organization that provides the World Industrial Infrastructure. MIDC has played a vital role in the development of industrial infrastructure in the state of Maharashtra. As the state steps into the next millennium, MIDC lives up to its motto ‘Udyamat Sakal Samruddhi’ i.e., Prosperity to all through industrialization.

Indeed, in the endeavour of the state to retain its prime position in the industrial sector, MIDC has played a pivotal role in the last 35 years. MIDC has developed 268 industrial estates (major & mini) across the state which spread over 52653 hectares of land. The growth of the Corporation, achieved in the various fields, during the last three years, could be gauged from the fact that the area currently in possession of MIDC has doubled from 25,000 hectares in 1995.
Maharashtra Industrial Development Corporation is the premier body for the development of IT Industry in Maharashtra. The MIDC has constructed 15 IT Parks in the state. The Government of India in 1988 announced a scheme for development of growth centres covering each District of the State. Out of these growth centres, 61 have been notified and in 24 growth centres, the land is already in possession and in 17 growth centres, MIDC has already started allotment of plots.

The State Government has also announced a programme of establishment of 140 mini industrial areas at Taluka levels. This work has also been entrusted to MIDC. Among 102 areas, land is already in possession 90 industrial areas and plots have already been allotted to small scale entrepreneurs.

MIDC is also a “special planning authority” for all its industrial areas for various functions such as selection of land, planning, development and management of industrial parks. Other objectives are

- Development of industrial areas by acquiring land.
- Preparing layout with suitable grouping of plots of various sizes and allotment of plots on leasehold basis.
- Construction of roads, drainage system and provision of street lights in the industrial areas.
- Planning, implementation and managing water supply schemes.
- Establishing common facility centers (CFC) by providing accommodation for bank, post office, telecom facilities, police station, fire station, medical facility, canteen, etc.
- Establishment of effluent collection and disposal systems for chemicals zones.
- Implementing government/semi government projects.

1.1.1 Achievements at a glance

Since its inception, MIDC has established at least one industrial area in every District of the State.
- 225 industrial areas (including Major, Mini, etc.) are functioning out of 268 notified industrial areas by the Government.
- 52,653 hectares of land in possession out of 86,822 hectares planned.
- 44,598 plots (including Industrial, Commercial, amenities, residential, etc.) are allotted out of 54,304 plots demarcated.
- 3,199 kms. length of pipeline constructed by MIDC.
- Construction and maintenance of airstrips and helipads.
- MIDC has developed five star rated industrial areas with state-of-the-art infrastructure at nine strategically located centres in Maharashtra.
- MIDC has acquired 90,000 hectares of land for industrial development.
- 2,235 kms of road has been laid by MIDC as a part of infrastructure facilities on offer.
- 1,300 industrial units already operating in MIDC parks—another 3,887 units are under Implementation.

Development of 5-star industrial areas at 9 centres:
1. Butibori (Nagpur)
2. Mahad (Raigad)
3. Kagal–Hatkangale (Kolhapur)
4. Sinnar (Nashik)
5. Indapur (Pune)
6. Shendre (Aurangabad)
7. Nivli Phata (Ratangiri)
8. Krushnoor (Nanded)
9. Nandgaon Peth (Amaravati)

are the top quality infrastructure is being developed by MIDC.

1.1.2 Ahmednagar MIDC
Ahmednagar Industrial area was established by MIDC in the year 1972. The area is well developed with quality infrastructural facilities such as roads, water supply and street lights. Many renowned industries are operating from this area.
MIDC had acquired 591 hectares of land for the area. Recently, MIDC opened a software park for the IT industry and also constructed an IT Tower here. Besides, MIDC has developed a residential zone for the employees and owners of the companies.

Objectives of MIDC are

- Rapid and orderly establishment and growth of firms in the entire area to achieve balanced industrialization.
- To achieve balanced industrial development of Ahmednagar with an emphasis on developing parts and underdeveloped parts of the firms.
- Facilitate entrepreneurs in setting up firms at various locations in MIDC.
- Infrastructural development in setting up firms at various locations in MIDC.

Following are the activities efficiently carried out by MIDC

- Developing industrial areas through acquisition of appropriate land.
- Planning and developing industrial parks, providing basic infrastructure such as roads, drainage systems, power and water in the industrial parks.
- Planning, implementing and managing water supply schemes.
- Co-ordinating with other infrastructure providers for electricity, telecom, connectivity, etc.
- Establishing common facility centres by providing banks, post offices, telecom facilities, police stations, fire stations, medical facilities, canteens, etc.
- Establishing effluent collection and disposal systems for chemical zones.
- Providing residential areas for housing industrial workers.

The Ahmednagar MIDC has been declared as an agent of the State Government for carrying out the activities within the framework of the MID Act and the MID Rules. These activities can be divided under following three broad categories
1. **Acquisition & disposal of land**: The land for industrial areas is acquired by the Government of Maharashtra under Chapter VI of the MIDC Act. 1961 and handed over to the Corporation for further disposal. Likewise, wherever available, the Government land is also handed over to the Corporation as an industrial area. The Government pays for the compensation for the private land from its own fund. The Corporation in turn plans the area and disposes the land in suitable plots by leasing out for 95 years.

For this purpose the Corporation recovers the premium lease money at different rates for different industrial areas. Also the Corporation constructs built-up accommodations like Sheds and Flatted units and sale them out to the prospective industrialists together with the land there under on lease basis. As on 31.3.2002 the Corporation has planned 673.72 (Hectares) of land against which 591.02 Hectares of land has already come in possession of the Corporation.

2. **Provision of infrastructure facilities**: In terms of the provision of the MID Act, 1961 and the relationship prescribed by the government in that regard, the corporation is required to provide infrastructure facilities like roads, streetlight, drainage, water supply schemes and buildings for common facilities like post & telegraphs, canteen, bank, and telephone etc. The corporation meets the expenditure on such works (facilities) generally from the premium lease money received by it from the allottees.

The relationship further prescribes that the industrial area, after it is fully developed, should be returned back to the Government/handed over to such agency or authority as the State Government may directs, after striking out the account of the industrial area concerned. The surplus/deficit generated out of such operations is to be made good to or recovered from the state government as the case may be. As the development of an industrial area is a long process and instant objective, the government has prescribed certain scale of interim
annual payments which are termed as on account advance payment to government.

In this connection it may stated that the powers to fix the rates of premium for land for different industrial areas rest with the corporation. Since it is the aim of the government and the corporation to achieve a balanced development of the entire State with special emphasis on the development of backward regions of the state, the Corporation follows a policy of cross subsidization rate structure on A B C D zones pattern, in that the rates of land premium in developed and semi developed parts of the State are higher compared to the rates in developing and backward regions.

3. **Providing of services:** The Corporation provides the following services to the units in its industrial areas:–

   a) **Assured Water Supply:** From among the various services provided by the Corporation, an assured pure water supply can be regarded as a unique specialty of the MIDC. The investment on the water supply scheme (Head works) made by MIDC as on 31st March, 2002 is over Rs.5 crores with installed capacity of water supply of 25 MLD. For the purpose of regulating the water supply operations of the Corporation the Government of Maharashtra has prescribed a legal and financial relationship between the Government and the Corporation.

   b) **Maintenance of Industrial Areas:** This is a municipal function requiring the Corporation to maintain the Roads, Street lights, Fire stations (in few areas) during the transitory period up to handing over of the industrial area either to Government or other agency as the Government may decide. The MIDC Act, vide Section 56, provides for the exits policy after the purpose of industrial development as contemplated in the Act is fulfilled.

However, this has seldom become possible in the absence of a substitute agency to take over the responsibility, except in few cases like that of Marol, Wagale
Estate, Pimpri Chinchwad etc. where the Corporation could hand over only the roads and street lights to local Municipal Corporations. In other areas, the Corporation carries on this function as a committed obligation. For this purpose the Corporation recovers service charges to defray the expenditure on such services.

c) **Drainage (effluent disposal) and CETP Schemes**: The Corporation has effluent disposal (drainage) schemes only in selected Industrial areas having chemical industries. Such schemes are designed to collect and discharge the treated effluent only. In such areas the Corporation recovers drainage cess to defray the expenditure on maintenance and to partially recover the capital cost. Also with a view to arrest pollution, the Corporation has started the operations like Hazardous waste Management and common effluent plants on Joint venture basis with the help of local industries associations.

d) **Other Services**: Theses include providing and maintaining Common Facility Centers like P&T, Banks etc. Though the Corporation does not levy any specific cess for the purpose, the C. F. C. building is subject to rentals. Such rental together with other miscellaneous income from the area covers the maintenance cost of such CFCs.

The policy decisions taken by Ahmednagar MIDC certainly changed the social economic scenario of the city as its activities spread in the interior. The important policy decision of setting up "independent filtered /potable water supply system of adequate capacity" as essential infrastructure for industrial development was the most intelligent step taken by Ahmednagar MIDC right in the beginning. It stabilized the population base near the industrial areas. The strategically wise decision taken simultaneously to provide water supply to nearby domestic population from the capabilities created by Ahmednagar MIDC of their own water supply system resulted in a phenomenal urban growth in the nearby small towns and villages.
Reference

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1.2  SMALL SCALE MANUFACTURING UNITS IN INDIA

With the advent of planned economy from 1951 and the subsequent industrial policy followed by Government of India, both planners and Government earmarked a special role for small scale manufacturing units in the Indian economy. Due protection was accorded to this sector, particularly from 1951 to 1991, till the nation adopted a policy of liberalization and globalization. Certain products were reserved for small scale manufacturing units for a long time, though this list of products is decreasing due to change in industrial policies and climate.

Small scale manufacturing units always represented the model of socio-economic policies of Government of India which emphasized judicious use of foreign exchange for import of capital goods and inputs; labour intensive mode of production; employment generation; non concentration of diffusion of economic power in the hands of few (as in the case of big houses), discouraging monopolistic practices of production and marketing; and finally effective contribution to foreign exchange earning of the nation with low import-intensive operations. It was also coupled with the policy of de-concentration of industrial activities in few geographical centres.

It can be observed that by and large, small scale manufacturing units in India met the expectations of the Government in this respect. Small scale manufacturing units developed in a manner, which made it possible for them to achieve the following objectives:

- High contribution to domestic production
- Significant export earnings
- Low investment requirements
- Operational flexibility
- Location wise mobility
- Low intensive imports
Capacities to develop appropriate indigenous technology
Import substitution
Contribution towards defence production
Technology – oriented industries
Competitiveness in domestic and export markets

At the same time one has to understand the limitations of small scale manufacturing units, which are
Low Capital base
Concentration of functions in one / two persons
Inadequate exposure to international environment
Inability to face impact of WTO regime
Inadequate contribution towards R & D
Lack of professionalism

In spite of these limitations, the small scale manufacturing units have made significant contribution towards technological development and exports. Small scale manufacturing units have been established in almost all-major sectors in the Indian industry such as food processing, agricultural inputs, chemicals & pharmaceuticals, engineering, electrical, electronics, electro-medical equipment, textiles and garments leather and leather goods, meat products, bio-engineering, sports goods, plastics products, computer software, etc.

1.2.1 Small scale manufacturing units in Maharashtra
Since its inception in May 1960, (and even earlier as a part of ‘Bombay State’) Maharashtra has been in the forefront of industrialization. The state has always followed progressive industrial policies and industry – friendly measures. Through a network of District Industries Centre’s (DICs), it offers maximum guidance and assistance to small scale manufacturing units. Many small scale manufacturing units promoted by local entrepreneurs as also by NRIs and foreigners have come up in Maharashtra covering a broad spectrum of industrial activity. The quality of
products of small scale manufacturing units from Maharashtra is high. Some of them have acquired technology from abroad. Adequate budget is provided for R & D operations. Many units are promoted by techno-entrepreneurs. In view of the objective of the study, it was considered necessary to undertake a survey of small scale manufacturing units from major parts of Maharashtra covering following sectors:

*Engineering, Electrical, Food Processing, Chemical and Pharmaceutical*

### 1.2.2 Small scale industrial undertakings

The following requirements are to be complied with by an industrial undertaking to be graded as Small Scale Industrial undertaking w.e.f. 21.12.1999

"An industrial undertaking in which the investment in fixed assets in plant and machinery whether held on ownership terms on lease or on hire purchase does not exceed Rs10million."

(subject to the condition that the unit is not owned, controlled or subsidiary of any other industrial undertaking)

**Explanation**

a. "owned" shall have the meaning as derived from the definition of the expression "owner" specified in clause (1) of section 3 of the said Act;

b. "subsidiary" shall have the same meaning as in clause (47) of section 2, read with section 4, of the Companies Act, 1956 (1 of 1956);

c. the expression "controlled by any other industrial undertaking" means as under:-

i. where two or more industrial undertakings are set up by the same person as a proprietor, each of such industrial undertakings shall be considered to be controlled by the other industrial undertaking or undertakings,

ii. where two or more industrial undertakings are set up as partnership firms under the Indian Partnership Act, 1932 (1 of 1932) and one or more partners
are common partner or partners in such firms, each such undertaking shall be considered to be controlled by other undertaking or undertakings.

iii. where industrial undertakings are set up by companies under the Companies Act, 1956 (1 of 1956), an industrial undertaking shall be considered to be controlled by other industrial undertaking if:-

a. the equity holding by other industrial undertaking in it exceeds twenty four percent of its total equity; or

b. the management control of an undertaking is passed on to the other industrial undertaking by way of the Managing Director of the first mentioned undertaking being also the Managing Director or Director in the other industrial undertaking or the majority of Directors on the Board of the first mentioned undertaking being the equity holders in the other industrial undertaking in terms of the provisions of the following items (a) and (b) of sub-clause (iv);

iv. the extent of equity participation by other industrial undertaking or undertakings in the undertaking as per sub-clause (iii) above shall be worked out as follows:-

a. the equity participation by other industrial undertaking shall include both foreign and domestic equity;

b. equity participation by other industrial undertaking shall mean total equity held in an industrial undertaking by other industrial undertaking or undertakings, whether small scale or otherwise, put together as well as the equity held by persons who are Directors in any other industrial undertaking or undertakings even if the person concerned is a Director in other Industrial Undertaking or Undertakings;

c. equity held by a person, having special technical qualification and experience, appointed as a Director in a small scale industrial undertaking,
to the extent of qualification shares, if so provided in the Articles of
Association, shall not be counted in computing the equity held by other
industrial undertaking or undertakings even if the person concerned is a
Director in other industrial undertakings or undertakings;

v. where an industrial undertaking is a subsidiary of, or is owned or controlled
by, any other industrial undertaking or undertakings in terms of sub-
clauses (i), (ii) or (iii) and if the total investment in fixed assets in plant and
machinery of the first mentioned industrial undertaking and the other
industrial undertaking or undertakings clubbed together exceeds the limit of
investment specified in paragraphs (1) or (2) of this notification as the case
may be, none of these industrial undertakings shall be considered to be a
small scale or ancillary industrial undertaking.

Note-
(a) In calculating the value of plant and machinery for the purposes of paragraphs
(1) and (2) of this notification, the original price thereof, irrespective of whether
the plant and machinery are new or second hand, shall be taken into account.
(b) In calculating the value of plant and machinery, the following shall be
excluded, namely:-

i. the cost of equipments such as tools, jigs, dies, moulds and spare parts for
   maintenance and the cost of consumable stores;

ii. the cost of installation of plant and machinery;

iii. the cost of research and development equipment and pollution control
equipment;

iv. the cost of generation sets and extra transformer installed by the undertaking
   as per the regulations of the State Electricity Board;

v. the bank charges and service charges paid to the National Small Industries
   Corporation or the State Small Industries Corporation;
vi. the cost involved in procurement or installation of cables, wiring, bus bars, electrical control panels (not those mounted on individual machines), oil circuit breakers or miniature circuit breakers which are necessarily to be used for providing electrical power to the plant and machinery or for safety measures;

vii. the cost of gas producer plants;

viii. transportation charges (excluding of sales tax and excise) for indigenous machinery from the place of manufacturing to the site of the factory;

ix. charges paid for technical knowhow for erection of plant and machinery;

x. cost of such storage tanks which store raw materials, finished products only and are not linked with the manufacturing process; and

xi. cost of fire fighting equipments.

(c) In the case of imported machinery, the following shall be included in calculating the value, namely:-

i. import duty (excluding miscellaneous expenses as transportation from the port to the site of the factory, demurrage paid at the port);

ii. the shipping charges;

iii. customs clearance charges; and

iv. sales tax.

Every industrial undertaking which has been issued a certificate of registration under section 10 of the said Act or a license under sections 11, 11A and 13 of the said Act by the Central Government and are covered by the provisions of paragraphs (1) and (2) above relating to the ancillary or small scale industrial undertaking, may be registered, at the discretion of the owner, as such, within a period of one hundred and eighty days from the date of publication of this notification in the Official Gazette.
1.2.3 Ancillary industrial undertakings
The following requirements are to be complied with by an industrial undertaking for being regarded as ancillary industrial undertaking:

An industrial undertaking which is engaged or is proposed to be engaged in the manufacture or production of parts, components, sub-assemblies, tooling or intermediates, or the rendering of services and the undertaking supplies or renders or proposes to supply or render not less than 50 per cent of its production or services, as the case may be, to one or more other industrial undertakings and whose investment in fixed assets in plant and machinery whether held on ownership terms or on lease or on hire-purchase, does not exceed Rs 10 million.

1.2.4 Tiny enterprises
Investment limit in plant and machinery in respect of tiny enterprises is Rs 2.5 million irrespective of location of the unit.

A small scale industrial unit/ industry related service or business enterprise, managed by one or more women entrepreneurs in proprietary concerns, or in which she/they individually or jointly have a share capital of not less than 51% as Partners/ Shareholders/ Directors of Private Limits Company/ Members of Cooperative Society.

Reference
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1.3 SUPPLY CHAIN MANAGEMENT

The term “supply chain management” arose in the late 1980’s and came into widespread use in the 1990’s. Prior to that time, business used terms such as “logistic” and “operation management” instead some broader definitions of supply chain as well as supply chain management are preferable, if one wants to maximize the opportunity to improve performance of an organization. According to Stock & Lambert (2001), “supply chain integrates the key business processes of an organization from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders”.

Mohanty and Deshmukh (2004) describes, “A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products and the distribution of these finished products to customers. Supply chain exists in both service and manufacturing organization, although the complexity of chain may vary greatly from industry to industry and firm to firm.”

The supply chain encompasses all activities associated with the flow and transformation of goods from the raw material stage, through to the end user as well as the associated information flows. Supply chain management is the integration of these activities through improved supply chain relationships, to achieve a competitive advantage. A supply chain extends from customer’s customer to supplier’s suppliers.

In today’s rapidly changing business environment, ever-greater demands are being placed on business to provide right products and services quicker with greater added value to the correct location with no relevant inventory position.

A supply chain consists of all the activities starting from sourcing of raw materials or components till delivery of the finished products to the customer. Supply chain management is, therefore, the management of these activities so as to maximize the
benefit to the organization. Supply chain management takes a holistic view of the working of an organization, without getting unduly obsessed with the performance of the chain of activities, the primary driving force being delivering value to the customer. A schematic representation of the supply chain is given in the figure 1.

Kotler (1998) defines customer delivered value as the difference between total customer value and total customer cost. And total customer value is the bundle of benefits customers expect from a given product or service. According to him, customer added value is a set of product value, service value, personnel value, and image value; total customer cost is composed of monetary price, time of value delivery system. Value delivery system depends on the combinative capabilities of product delivery and service delivery processes.

Gattorna and Walters (1996) have extended this concept to the design of supply chain. The supply chain is the network of organizations that are involved through upstream and downstream linkages in the different processes and activities that produce value in the form of products and services in the hands of ultimate
customers (Christopher, 1998). Lalende and powers (1993) mentioned that value delivery system defines the relationships between organizational entities in the supply chain. Hoover et al (2001) mentioned that in a turbulent market environment, the ways companies make, adapt, sell and distribute define the characteristics of a value delivery system and such a system is turning into a major source of competitive edge. According to them, the order-to-payment process is the company’s value chain and is much broader than the supply chain depicts a value chain.

**What is 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.

**Evolution of Supply Chain Management**

The 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. Consider the following statement made by the chief executive of an automobile firm:

*Our aim is always to arrange the material and machinery and to simplify the operations so that practically no orders are necessary.*

*Our finished inventory is in transit. So is most of our raw material inventory. Our production cycle is about eighty-one hours from the mine to the finished machine (automobile) in the freight car.*

It is clear from this statement that this firm had 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. Indeed, this statement came not in the 1960s or 1970s. Rather, Henry Ford achieved this fine balance in the 1910s with the Ford Motor Company. Clearly, this achievement set the standard for all managers the world over. There have been three major revolutions along this journey

The First Revolution (1910-1920): The Ford Supply Chain

The first major revolution was staged by the 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. 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.

The Second Revolution (1960-1970): The Toyota Supply Chain

Towards 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 ushering in the second revolution.

The 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 were 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. The 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. This combination of low set-up time relationships with suppliers was the key feature that propelled the second revolution and it was a long journey from the rigidly integrated Ford supply chain. The principles followed by Toyota are more popularly known as lean production systems.

The Toyota system, involving tight linkages, did get into some problems in the later part of the century. Gradually, when 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 complacent 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 manufacturer’s plant.
In actual practice, the Toyota supply chain also had certain rigidities, such as a permanent relation with suppliers, which could become a liability over a period of time. This, in turn, led to the third revolution spearheaded by Dell Computers, which offered its customers the luxury of customization with loosely held supplier networks.

**The Third Revolution (1995-2000): The Dell Supply Chain**

With advances in information technology (IT), Dell Computers allowed customers to customize their computers. Dell allowed customers to configure their own PCs and track the same in their production and distribution systems. Unlike the Toyota supply chain, Dell did not believe in long-term relationships with suppliers. Dell believed in working with world-class suppliers who would maintain their technology and cost leadership in their respective fields. Dell maintained medium-term relationships with suppliers, where the suppliers were always on test. Because of advances in IT, Dell could integrate the suppliers electronically, even if they were partners only for a medium term.

At Dell, the trigger for supplier orders was the actual orders by customers, and not forecasts. This helped Dell in reducing the inventory significantly, allowing them to respond to any changes in the market place. Since their suppliers were electronically integrated and as they did not want rigidity in the chain, Dell did not see any advantage in locating suppliers close to their assembly plants.

With increased use of IT in supply chain management, it became possible to achieve operational integration even with those suppliers with whom a firm may not have long-term relationships. Essentially, on the product-variety front, firms have progressed from a single product to a wide variety and from a wide variety to customization. Similarly, on the chain – ownership front, firms have progressed from vertically integrated firms to long-term partnerships with chain partners and from long-term partnerships to loosely held networks.
Advances in IT have fuelled the third revolution, and the exact contours of the third revolution are still being defined. It will probably take a couple of years before we understand the model fully and apply it to all industries.

As established in this discussion, the three major revolutions in supply chain management have been fuelled by a dynamic economy and market. Rapid advances in technology, changing economic policies and similar factors have spurred growth and expansion. This has forced firms to find better and more efficient ways of supply chain management. With this backdrop in mind, let us look at key supply chain concepts and try to understand why a supply chain has become such a critical success factor in most industries.

**Why supply chain?**

Companies across the world are looking forward to value innovation as the strategic logic for high growth. World-class value adding performance outputs are as follows:

**Quality**: the quality of products and services should be virtually defects-free line. (In some cases, 10 or fewer defective parts per million (PPM). At many firms, over 50% of all quality defects can be traced back to purchased materials.

**Cost**: the supply chain management function must focus on strategic cost management: the process of reducing the total cost of acquiring, moving, holding, converting and supporting products containing purchased materials and services throughout the supply chain.

**Time**: total cycle time requires the examination of every aspect of the firm’s operation, meticulously eliminating all redundant of non-value-added, but time-consuming activities from the process.

**Technology**: the supply chain management function has two key responsibilities in the area of technology: It must ensure that the firm’s supply base provides
appropriate technology in a timely manner, and it must ensure that technology which affects the firm’s core competencies (the “thing” that gives the firm its unique reason for being) is carefully controlled when dealing with outside suppliers and customers.

Continuity of supply: monitoring the trends, developing appropriate supplier alliances and taking such other actions as required to reduce the risk of supply disruptions.

Today, it is need of the time that all firms should understand the importance of supply chain management principles can have a positive impact on its overall success. It is one of the major functions common to many types of organizations: the overall goal of supply chain management is to impact the organisation’s bottom line in a positive way. While it involves a number of actions, the objectives of supply chain management can be summarized around the following major goals:

- Provide an uninterrupted flow of materials, supplies and services required to operate the organization.
- Keeps inventory investment at a minimum.
- Maintain and improve quality.
- Find and develop competent suppliers.
- Purchase required items and services at lowest total cost.
- Improve the organisation’s competitive position.
- Achieve harmonious, productive working relationships with other functional areas within the organization.
- Accomplish the purchasing and marketing objectives at the lowest possible level of administrative costs.

Traditionally marketing, distribution, planning, manufacturing and the purchasing organizations along the supply chain operated independently. These organizations have their own objectives and these are often conflicting. For example, high
customer service and maximum sales objectives of marketing may conflict with manufacturing and distribution goals. Many manufacturing operations are designed to maximize output volumes and lower costs with little or no consideration for the impact on inventory levels and distribution capabilities.

Purchasing contracts are often negotiated with very little information beyond historical buying patterns. The result of these conflicting objectives is that there is not a single, integrated picture of the organization as a whole. Hence, there is a need for an integrated picture through which these different functions can be integrated together. Today, it is indeed possible through IT (information technology) to achieve this type of integration. Supply chain management is the combination of art and science that goes into improving the way your company finds the raw component it needs to make a product or service, manufacture that product or service and delivers it to customers.

The following are the basic components for supply chain management:

1. **Plan**: this is the strategic portion of supply chain management. One needs a strategy for managing all the resources that go towards meeting customer demand for product or service. This may include developing a set of metrics to monitor the supply chain so that it is efficient, cost less and delivers high quality and value to customers in the most cost effective manner.

2. **Source**: One has to choose the suppliers that will deliver the goods and services needed to create final product or service. This involves developing a set of pricing, delivery and payment processes with suppliers and metrics for monitoring and improving the relationships. This also involves putting together processes for managing the inventory of goods and services from suppliers, including receiving shipments, verifying them, transferring them to manufacturing facilities and authorizing supplier payments.
3. **Make**: This is the manufacturing step. This involves making schedule for the activities necessary for production, testing, packaging and preparation for delivery. This phase is the metric-intensive portion of the supply chain, as it requires measurement of quality levels, production output and worker and asset productive.

4. **Deliver**: Generally, this is referred to as “logistics”. This involves the coordination of receipts of orders from customers and setting up an invoicing system to receive payments.

5. **Return/Reverse Flow**: This refers to the reverse flow of goods from customer back to the manufacturer. This involves creating a network for receiving defective and excess products back from customers and supporting customers who have problems with delivered products. The payment/discounts procedure needs to be established.

**The 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. This is evident from the fact that every time a customer walks into a neighbourhood 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
neighbourhood store, do not be surprised to find that even a simple product like toilet soap has 50-odd varieties.

We define stock-keeping unit (SKU) as a unit of variety. For example, the same brand of soap may be offered in varying colours and sizes. Each variety is treated as a separate SKU. Companies like HUL, in their personal care products, manage, on an average, 1,200 SKUs. Chains like Food world, manage about 6,000 SKUs. With increasing product variety, it becomes rather difficult to forecast accurately. Hence, retailers and other organization involved in the business are forces to either maintain greater amount of inventories or lose customers.

2. **Shorter product life cycles**: With increased competition, product life cycles across all industries are becoming shorter. For example, the PC industry works with a life cycle as short as 6 months. So a firm like Dell, which has, on an average, just 7 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.

In the past, in developing countries where inflation was a way of life, higher inventories used to be a major source of profits for the firm. With inflation in control and shorter product life cycles, firms have had to change the way they manage their inventories. Also, with shorter product life cycles, there is not much data available for demand forecasting. 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**: As discussed the section on “Evolution of Supply Chain Management”, firms increasingly focus on their core activities and outsource non-core activities to other competent players. Michael Dell, CEO of Dell Computers, had mentioned that if his company was vertically integrated, it
would need five times as many employees and would suffer form a drag effect. Apart from primary activities in the value chain, even support activities that were usually done in-house are outsourced in a big way now. Bharti Tele-Ventures, India number one private telecom service provider, has outsourced network-management services, IT services and call centre operations. This trend towards outsourcing is irreversible but a higher level of outsourcing makes supply chains more vulnerable, thereby forcing firms to develop different types of supply chain capabilities within the organization.

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 precuts 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. Savvy 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.

Retailers have realized that they are powerful entities in the chain and hence expect the manufacturers to be more responsive to their needs and demands. Discount retailers like Wal-Mart have been asking their suppliers to replenish the supplies on a daily basis based on actual sales data from their point-of-sales systems. In general, manufacturers are forced to respond more quickly to the customer’s 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. Unlike in the past, when firms use to source components, produce goods and sell them locally, now firms are integrating
their supply chain for the entire world market. For example, companies like ABB have developed some global centre of excellence for each of their product lines that take care of the global market.

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. This has made managing supply chains extremely complicated. Unlike information and finance flow, which can be managed electronically, materials and products have to move physically, and as this movement can even be across continents, managing supply chains is now an extremely complex issue.

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1.3.1 Strategic decisions in Supply Chain Management

Strategy is generally associated with long-term decisions. Choosing the timing, the location, and the scale of construction of new manufacturing facilities are typical long-term manufacturing and operation strategy decisions. Making these decisions requires information about the forecast for new and existing products, and changing characteristics of the market place, and changes in the costs and availability of resources.

Supply chain strategy must address the groundwork for building the proper channels for sales and distribution as well as facilities design and development. Time horizons affect the impact of decisions, the uncertainties surrounding those decisions, and the penalty for wrong decisions. Short time horizons involve many decisions, each of whose impact may be small, but cumulatively can make a difference.

Typically the decisions for supply chain management can be organized into broad categories- strategic, tactical and operational. As the firm implies, strategic decisions are made typically over a longer time horizon. These are closely linked to the corporate strategy, and guide supply chain policies from a design perspective.

On the other hand operational decisions are short-term, and focus on activities over a day-to-day basis. The tactical decisions are in between these two. The effort in these types of decisions is to effectively and efficiently manage the material flow and information flow in the “strategically” planned supply chain. Strategic supply chain management is directly related and draws strengths from the business strategy of an organization. As a matter of fact, the supply chain strategy is developed from business strategy.

On the strategic level, long-term decisions are made. These are related to location, production, inventory, and transportation. Location decisions are concerned with the size, number, and geographic location of the supply chain entities, such as
plants, inventories, or distribution centers. The production decisions are meant to determine which products to produce, where to produce them, which suppliers to use, from which plants to supply distribution centers, and so on. Inventory decisions are concerned with the way of managing inventories throughout the supply chain. Transport decisions are made on the modes of the transport to use.

Decisions made on the strategic level are, of course, interrelated. For example, decisions on mode of transport are influenced by decisions on geographical placements of plants and warehouses and inventory policies are influenced by choice of suppliers and production locations. Modeling and simulation is frequently used for analyzing these interrelations and the impact of making strategic level changes in the supply chain.

On the tactical level, medium term decisions are made; such as weekly demand forecasts, distribution and transportation plan, production planning, and materials requirement planning. The operational level supply chain management is concerned with the very short term decisions made from day to day. The border between the tactical and operational level is vague.

The supply chain strategy to be developed should be fully aligned. Alignment means that it should pursue the same goals and objectives as laid under the business strategy. There cannot be departures or deviations as otherwise negative results can emerge, entities frittered away and resources spent wasted. Generally, there are four major decision areas in supply chain management:

- **Location decisions:** The geographic placement of production facilities, stocking points and sourcing point is the natural first step in creating a supply chain. The location of facilities involves a commitment of resources to a long-term plan. Once the size, number, and location of these are determined, so are the possible paths by which the product flows through to the final customer. These decisions are of great significance to a firm since they represent the basic
strategy for assessing customer markets, and will have a considerable impact on revenue, cost, and level of service. These decisions should be determined by an optimization routine that considers production costs, taxes, duties, and duty drawback, tariffs, local content, distribution costs, production limitation, etc. although location decisions are primarily strategic, they also have implications on an operational level.

- **Production Decisions**: The strategic decision include what products to produce, and which plant to produce them in, allocation of suppliers to plants, plants to DCs, and DCs to customer markets. As before, these decisions have a big impact on the revenues, costs, and customer service levels of the firms. These decisions assume the existence of the facilities. But determine the exact path(s) through which a product flows to and from these facilities- and this largely depends the degree of vertical integration within the firm. Operational decisions focus on detailed production schedules, scheduling production on machines, and equipment maintenance. Other considerations include workload balancing, and quality control measures at a production facility.

- **Inventory Decisions**: These refer to means by which inventories are managed. Inventories exist at every stage of the supply chain as either raw material, semi-finished or finished goods. They can also be in process between locations. Their primary purpose is to buffer against any uncertainty that might exist in the supply chain. Since holding of inventories can cost anywhere between 20 to 40 percent of their value, their efficient management is critical in supply chain operations. It is strategic in the sense that top management sets goals. However, most researchers have approached the management of inventory from an operational perspective. These include deployment strategies (push versus pull), control policies- the setting safety stock levels at each sticking location. These are critical, since they are primary determinants of customer service levels.
Transportation Decisions: The mode choice aspects of these decisions are the more strategic ones. These are closely linked to the inventory decisions, since the best choice of mode is often found by trading-off the cost of using the particular mode of transport with the indirect cost of inventory associated with that mode. While air shipments might be fast, reliable and warrant lesser safety stocks, they are expensive.

Shipping by sea or rail may be much cheaper, but they necessitate holding relatively large amounts of inventory to buffer against the inherent uncertainty associated with them. Therefore customer service levels and geographic location play vital roles in such decisions. Since transportation is more than 30 percent of the logistic costs, operating efficiently makes good economic sense. Shipment sizes (consolidated bulk shipments versus lot-for-lot), routing and scheduling of equipment is key in effective management of the firm’s transport energy.

The strategic decisions are, for the most part, global or “all encompassing” in that they try to integrate various aspects of the supply chain. Consequently, the models that describe these decisions are huge, and require a considerable amount of data. Often due to the enormity of the data requirements, and the broad scope of decisions, these models provide appropriate solutions to the decisions they describe. The operational decisions, meanwhile, address the day-to-day operation of the supply chain. Therefore the models that describe them are often very specific in nature. Due to their narrow perspective, these models often consider great detail and provide very good, if not optimal, solutions to the operational decisions.

Successful supply chain management involves several decisions with varying time frames. Supply chain design (network design) or 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.

Given the demand forecast and the business strategy of the firm, decision related to procurement, production, planning, distribution and transportation have to be integrated with customer order processing and inventory management decisions. Relationship management essentially involves the alignment of incentives to the various entities in the chain so that the overall supply chain performance meets customer requirements at the lowest cost.

Though not so obvious, the supply chain has also to be integrated with other important functions of the firm, for example, customer relationship management and new product development. Since customer relationship creates demand, the supply chain must ensure that it is in a position to fulfill the demand created by customer relationship management in a profitable way. Well managed firms integrate their customer relationship and supply chain activities. Similarly, while designing new products, well-managed firms ensure that supply chain issues are kept in mind at the design stage. Firms have to find a way in which the new products can use the existing product platforms and components, so as to minimize the supply chain costs for the product family as a whole.

**Business strategy**

Once an organization has settled in its mission, managers can turn their attention to developing the business strategy. These include:
Clearly identify the firm’s targeted customers, and broadly indicate what the operations and supply chain functions will need to provide value to those customers.

Identify and support the development of core competencies in the operations and supply chain areas. Core competencies represent one way in which firms can build a sustainable competitive advantage.

Set time frames and performance objectives that managers can use to track the firm’s progress towards fulfilling its business strategy.

Executing successful supply chain strategies really translates into choosing and implementing the right mix of these elements. Effective operations and supply chain strategies accomplish the following things:

- They ensure that the firm’s operations and supply chains excel on the performance dimensions that are valued by the firm’s targeted customers.
- They ensure that the firm’s operations and supply chain decisions are strategically aligned with the firm’s business strategy
- They help develop core competencies in the firm’s operations and supply chains.

The following guidelines are proposed to evolve a supply chain strategy.

- **Planning**: many companies develop plans to help guide what they hope to achieve in their supply chain business process. The problem is that many companies believe having a plan is the same as having a strategy. Just having a business plan is not enough to ensure success.

- **Pro-activeness**: one of the reasons Indian companies have fallen behind foreign competitors is that supply chain management has taken a subordinate role to marketing and finance function. This means SCM is always reacting to decisions by other units of the company and is always concerned with the short-
term issues. To be pro-active, companies must anticipate the potential of new practices and technologies and make sure that managers are involved in major engineering and marketing decisions.

- **Pattern of actions**: While it is important to have a SCM plan, what counts is the real life actions and decisions made by the management. These actions will determine whether a supply chain strategy is successful or not. The pattern of actions of a company reveals the real strategy of the firm.

- **Portfolio of supply chain capabilities**: these are the special abilities that a company has in managing its supply chain. Some examples of capabilities include cost, quality and performance. Managers should emphasize those capabilities because of which the company excels. For example, if the company has the ability to make products more cheaply than competitors, that ability should be exploited.

- **Programs of improvement**: These are the programs that the companies develop to improve capabilities needed to succeed in the market place. For example, the company may need to find ways to cut costs in manufacturing if competitors can offer less expensive products in the market place.

- **Performance measurement**: Managers need to find ways to evaluate how their company is doing at meeting its strategic goals. For example, a business that stresses a rapid delivery performance within the company.

Supply chain strategy need to be viewed from a broad perspective. Companies that develop such a perspective will be more successful in the global marketplace. Supply chains helps firms to provide products or services that someone values.

To begin, most customers evaluate products and services based on multiple performance dimensions such as functionality, delivery speed, after sales support, and cost. The organization that provides the best mix of these dimensions will be
seen as providing the highest value. Supply chains can have an enormous impact on many performance dimensions. Experience suggests that there are four performance dimensions that are particularly relevant to supply chain strategies. These are:

- **Quality**: The concept of quality is a broad one that can be sub-divided into the following categories:
  - *Functionality*: What are the characteristics or features of a product or service that determine how well it works? Products with many features or services that provide superior performance are often thought of as being of “higher quality”
  - *Conformance*: Was the product made or the service performed to specification? Examples of conformance quality include degree of purity, the weight of a product, and the amount of time it takes to perform a service.
  - *Reliability*: will a product work for a long time without failing or requiring maintenance? Does a service operation perform its task consistently over time?
  - *Durability*: can a product withstand adverse conditions, such as temperature extremes or rough handling? What is its “expected life”?
  - *Safety*: Was the product or service designed to be safe?
  - *Serviceability*: If necessary, can the product be easily repaired or services?
  - *Aesthetics*: Does the product or service appeal to the senses? Fresh-baked cookies or a shiny paint job are obvious examples.

The relative importance of these quality dimensions will differ from one customer to the next. One buyer may be more interested in reliability and serviceability, another in performance and aesthetics. To compete on the basis of quality, a firm’s operation and supply chain must consistently meet or exceed customer expectations or requirements on the most critical quality dimensions.
**Delivery**: Delivery performance has two basic characteristics: speed and reliability. Delivery speed is the elapsed time from the receipt of an order to final delivery. A firm with superior delivery speed can “deliver more quickly than its competitors or meet a required delivery date when only some or even none of the competition can do so”.

Typical strategies for improving delivery speed include streamlining the order entry process, holding inventory at key points in the supply chain (in stores or regional warehouses), maintaining excess capacity with which to meet “rush” orders, and using faster transportation. Delivery reliability refers to the ability to deliver products or services on time. Note that a firm can have long lead times yet still maintain a high degree of delivery reliability.

Typical measures of delivery reliability include the percentage of orders that is delivered by the promised time and the average tardiness of late orders. Delivery reliability is especially important to companies that are linked together in a supply chain.

**Flexibility**: Many supply chains compete by responding quickly to the unique needs of different customers. Both manufacturing and service firms can demonstrate flexibility. Manufacturers distinguish among several types of flexibility, including: mix flexibility, or the ability to produce a wide range of different products; changeover flexibility or the ability to begin production of a new product with minimal delay; design flexibility, or the ability to change the design of a product to accommodate specific customers; volume flexibility or the ability to produce whatever volume the customer needs.

Different types of flexibility may require different operations and supply chain solutions. Firms must decide which types of flexibility are important to their customers and adjust their operations and supply chain efforts accordingly. Flexibility has become particularly valuable in new product development. Some
firms compete by developing new products or services faster than their competitors, a competitive posture that requires operations and supply chain partners that are not only flexible, but willing to work closely with designers, engineers, and marketing personnel.

**Cost:** Cost is always a concern, even for companies that compete primarily on some other dimensions. In fact, in some industries, competition is so intense that firms are experiencing unrelenting pressure to reduce cost, even as their performance improves in other ways. Because operations and supply chain activities often accounts for most of the organisation’s cost, they are natural targets in cost reduction efforts. Cost is such an important performance dimension that we will refer to it.

**Trade-offs in SCM**
Trade-offs are forever in supply chain. Companies must select some performance attributes to favor at the expense of others. Most fundamental trade-off in a supply chain is between efficiency and flexibility. A highly efficient chain is between efficiency and flexibility. A highly efficient chain necessarily uses its capacity to the utmost, minimizes inventory at each location, and streamlines operation to achieve economies at scale at every link. By contrast, a flexible chain must maintain reserve capacity and inventory to respond quickly to anticipated demand; it must be able to produce and deliver products in varying quantities with short lead-time. Such requirements inevitably compromises efficiency.

The choice between efficiency and flexibility is not all or none. Rather, it’s a matter of degree, with each company finding its own best balance between these conflicting goals. A company that competes primarily on price has little choice but no sacrifice flexibility in search of efficiency, while a company that differentiates itself on quality of service must usually have a very flexible chain. Companies that differentiate based on the products require flexible chain to handle uncertain
demand, while mature products call for efficient chains to hold down costs. Uncertainty is certain. Web communication only removes some of the uncertainty. As long as some remains, countermeasures (buffers in the form of inventory) may be needed. Inventory is a visible and significant asset in most of the companies—often the largest. One can visualize trade-offs of the following types:

- Lot size (inventory) trade-off
- Transportation cost trade-off
- Lead time—Transportation trade-off
- Product variety—Inventory trade-off
- Cost—Customer service trade-off

We may not be able to reduce inventory to zero and have fast response, unless we have a huge amount of excess capacity in the production-distribution system. It may be more appropriate to have excess capacity if inventory is relatively expensive, especially for high-tech products. Trade-offs often is complicated, and involves several terms, not just two. Different parameters are important in different situations, but trade-offs should consider at least the cost dimensions associated.

Reference


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1.3.2 Outsourcing: Make versus Buy

The decision of a firm to perform its activities internally or get those activities done from an independent firm is known as the make versus buy decision. This make versus buy issue is strategic in nature and involves the following key decisions: What activities should be carried out by the firm and what activities should be outsourced? How to select the entities/partners to carry out 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?

**Identifying core processes**

The mere decision to focus the resources on core activities to match capabilities with the best-in-class performance is not enough; firms must strive to be the best in the world in that specific area. In these areas they can invest in people, equipments and R&D. Such a focus will also help the firm in attracting the best talent from that field. Many corporations have realized that they can never hope to attract the best talent in IT; hence, they have decided to depend on their outside partners for the IT support required for business application.

**The business process route**

For any firm, three core and high-level business processes include customer relationship, product innovation and supply chain management. Customer relationship focuses on acquiring new customers and building relationships with existing customers. Product innovation focuses on fulfillment of customer orders. It is possible to un-bundle the three business processes and a firm can afford to outsource two of these business processes.

**The product architecture route**

In the product architecture approach, the focus is on sub-systems and components and the make or buy decisions are made at that level. A product like a car can be
divided into sub-systems such as engine, chassis and transmission. The engine sub-system can be divided into components such as power cylinder, fuel system and engine electronics. In a product, first the sub-systems are classified as strategic and non-strategic. A sub-system is strategic if it involves technologies that change rapidly, if it requires specialized skill and technologies and if it can significantly impact the performance of the product on attributes that are considered important by the customer.

By keeping these strategic sub-systems internal, a firm can ensure that it can offer differentiated products and can avoid being commoditized. Further, within a sub-system, the same kind of analysis has to be done for all major components. All those components where the firm is technologically ahead of potential suppliers or can hope to achieve a leadership position with some investments are kept internal to the firm. In case the suppliers have a huge technological lead, which will be impossible to bridge in the foreseeable future, or if the time and investments required for catching up may not be worth the effort, then the component should be outsourced and the supplier should be treated as a strategic partner.

**The Make-versus-Buy continuum**

We started out by exploring two extreme positions: (a) make an input or buy an input using the market and (b) vertical integration versus market, where the buyer has an arm’s-length relationship with the suppliers. There are several alternative ways in which the exchange can be organized. In this section, we discuss two important alternatives:

1. Tapered integration, where a firm both makes and buys a given input.
2. Collaborative relationship, which could be a formal contractual relation or a long-term informal relationship, based on trust. In some cases, it can lead to alliances or joint ventures.
Sourcing strategy: Portfolio approach

Firms buy a large number of components and services and, of course, not all of them should be handled in the same way. The popular portfolio approach developed by Kraljic (See Figure 2) classifies items based on the importance of the item in terms of value of purchase (high versus low) and associated supply risk in the supply market. Supply risk captures two dimensions: number of suppliers in the market and the demand-supply gap in the supply market. If an item has very few suppliers who have monopoly in the market and supply is less than the demand, the buyer faces a significant supply risk.

In supply markets where there are large numbers of players and there is surplus capacity in the market, the items bought will be classified as low-supply-risk category items. Packaging material and transport service markets come in this category and represent low-risk items. Diesel engines, diesel fuel systems and proprietary technology items have few suppliers, so they represent the high-risk-supply category. For example, Bosch has a market share of 81 per cent in the fuel-injection equipment market, so obviously it comes under the high-risk category. Similarly, oil and steel in the early part of the 21st century represented the high-risk category because demand outstripped supply.

There was a strong demand for steel and fuel in India and China and, as a result, demand outstripped supply. Because of the supply uncertainty created by the disturbances in Iraq, the supply risk for oil increased significantly after the interventions by the United States of America in Iraq. Classifying items on their purchasing value is a straightforward issue because it just needs internal data and growth projections at the firm level. Supply risk, on the other hand, represents a more sophisticated analysis because the focus is on the supply markets, and in the case of many commodities, the supply markets are global in nature. So firms
should either develop adequate capability in this area or should take help from experts for carrying out this exercise.

As shown in Figure 2, the four quadrants are named as follows: routine products, leverage products, strategic products and bottleneck products. We take each category and discuss the sourcing strategy.

- **Routine products**: This quadrant represents significant opportunity. The focus is on reducing the number of parts and the number of suppliers. The aim is to reduce administrative and logistics complexity. The time saved here is used to focus on strategic suppliers and bottleneck suppliers. The focus is on moving to system buying rather than component buying.

A large number of items and suppliers come in this quarter, which represents a non-critical, low-valued supply. Unfortunately, managers end up spending much energy in this quarter. Ideally, the purchasing department should not waste its energy on small items. Rather, it should aggregate components into systems and start sourcing the systems. This issue is discussed in greater detail in the section titled “Reconfiguration of the Supply Base”.

![Figure 2: Purchasing portfolio analysis](image-url)
- **Leverage products**: This quadrant consists of high-value, standard products. These items provide an opportunity for leveraging buying power in low-supply-risk situations. In these supply markets, there are a large number of suppliers and switching costs are low. So firms should be aggressive in their attempts to encourage competitive bidding in order to leverage their position. Most of the benefits obtained by firms in reverse auctions have been in this category. A firm can reduce the number of suppliers and focus on operational-level integration so that apart from purchasing costs inventory and administrative efforts can also be reduced.

- **Strategic products**: This quadrant represents high-value products with high supply risks. This quadrant usually accounts for less than 5 per cent of the items and for almost 40 per cent of purchase value. Items in this quadrant are treated as strategic items, and a firm must work towards establishing collaborative, long-term relationships with suppliers in this quadrant.

  Firms must create opportunities for mutual cost reduction by working together on all aspects, including product design. Because fewer parts and suppliers are involved, firms can invest in building collaborative relationships. The top management of firms should get actively involved in devising a strategy for this category of items.

- **Bottleneck products**: These items represent relatively low value, but a firm is vulnerable on this front because of the supply risk inherent in this market. Since a firm is likely to be buying relatively smaller value, it is also unlikely to have much clout with suppliers. Here, the focus is on securing supply, and a firm should actively keep looking at alternative sources of supply. If possible, the firm should also look at substitutes that are from low-risk supply markets. For example, in the diesel fuel system, there may not be too many suppliers of the required capability and competence. A firm might try and develop a better
understanding of supplier priorities and their planning systems so that it can align its buying plan with the suppliers’ operating plans. For example, some steel producers produce certain grades of steel only once in a year. If an interested firm knew of their internal processes, it might be in a better position to obtain reliable supply. If required, the firm should also be willing to pay a premium for a reliable source of supply.

In doing the above-mentioned analysis, firms seem to focus on items involved in direct purchases or those that affect the cost of goods sold. But firms buy a huge quantity of indirect goods and services, such as travel, advertising, IT and human-resources-related purchases, which have rarely come under the radar of sourcing executives.

**Impact of the internet of sourcing strategy**

Some years back there was the view that the Internet will fundamentally alter the sourcing strategy of firms. A large number of researchers and practitioners argued that with the advent of the Internet, firms can source from anywhere is the world and that old ideas of sourcing will not be valid in the virtually connected world. During the days of the dotcom bubble, some analysts expected the three big auto companies GM, Ford and Chrystler to save to the tune of $2,500 per $19,000 vehicle, using the electronic collaborative exchange. In the post-dotcom-bubble era, firms have realized that the fundamentals of sourcing strategy remain valid in the post-Internet era also.

Ideally, firms prefer to evaluate a large number of potential suppliers, as a broadening range of suppliers will definitely help the firm in lowering the price at which it will buy the item. Also, a larger number of potential suppliers will reduce the risk of opportunistic behaviour, inherent in situations involving bargaining among a few parties that are highly dependent upon each other. Unfortunately, the costs involved in locating and evaluating the right supplier and the interactions are
strictly the function of the number of suppliers included in the search process. Consequently, a firm determines the optimal number of suppliers by trading off the cost of further searches against the expected benefit from identifying a better supplier. Since search and evaluation costs are lower for suppliers in the geographical neighbourhood, most of the firms traditionally work with a limited number of suppliers located in their geographical proximity. Internet technology has changed the nature and extent of costs involved in the search and evaluation process.

Because of advances in IT in general and the Internet in particular, costs related to computer-aided information search and coordination have declined, averaging 25 per cent per year. It was argued that the optimal number of suppliers in the consideration set is bound to increase as the Internet lowers search and evaluation costs. Further, suppliers in the consideration set will be globally distributed and not limited to the geographical neighbourhood of the firm. Also, the Internet fuelled a lot of electronic public market exchanges and industry sponsored exchanges where information about suppliers can be obtained without much effort.

These developments raised serious discussions among scholars and practitioners about the direction of evolution of the buyer-supplier relationship. There was also concern about whether we are going back to an era in purchasing where the only thing that mattered was the price.

Reference


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1.3.3 Inventory management in Supply Chain

The term supply chain refers to the complex sequence of activities, information and material flows involved in producing and distributing a company’s outputs. Supply chain consumes vast amounts of capital in the form of plant, equipment and inventories and is responsible for most of a firm’s cost of goods and operating expenses. Supply chains create significant value and ultimately determine a company’s ability to satisfy the demands of its customers. As a result, effective supply chain management is a major strategic challenge for most companies. But formulating effective strategy requires a good understanding of what drives cost and service in a supply chain. Inventories drive the cost of a company and customer service level very significantly.

**Definition of inventories**

Inventory can be defined as a stock of commodity which has got some economic value, but withdrawal of which requires an authorization. This definition has the following implications:

- A detailed, itemized list, report, or record of things in one’s possession, especially a periodic survey of all goods and materials in stock.
- The process of making such a list, report, or record.
- The items listed in such a report or record.
- The quantity of goods and materials on hand, stock, or in pipeline.
- The evaluation or a survey, as of abilities, assets, or resources.
- To make an itemized report or record.
- To include in an itemized report or record.

The amount of raw materials, work in process and finished goods being held for sale at a given time. Inventory is generally the least liquid item listed by a firm in the current asset account of its balance sheet.
Importance of inventory management in the Supply Chain

Managing inventory has become very important. This is due to the following factors.

- Resource availability (such as that of finance and space) has forced management to consider how best to lower the levels of inventory within the supply chain management systems in order to maintain margins.
- The changes in manufacturing philosophy, concepts like just-in-time applications (JIT) and lean manufacturing have reduced the need for inventory as an insurance buffer within the overall logistic activity.
- The realization by companies that a greater return on investment (ROI) can be obtained by developing the core business, and that investment is working capital items, such as inventory and debtors, returns far less in comparison to other initiatives.
- The developments on the front of information technology (IT), which provides a potential tool to reduce the inventory. Inventory and information can be traded. The better the information, the lower is the need for inventory. Information systems such as POS (point of sales), ERP (enterprise Resource Planning systems) can significantly reduce the inventory.

The importance of controlling inventory vis-à-vis customer service decisions is important. Typically, the following reasons may justify inventory:

- Enhance customer service, through a supporting role to marketing which, once having created demand, requires availability if goods if sales are to be affected.
- Leverage economies of scale by producing in large volumes (typically unit costs are lowest when product is a manufactured in long production run at constant quantities).
Similar to above, exploit economies of scale in purchase and transportation based on the notion that both product procurement and transportation cost will be reduced if lot sizes are large.

Inventory provides hedges against price changes: especially in India, observe the tendency to hoard commodities in anticipation of price rise just before the budget (in the month of January/February, just before the financial budget). This suggests that volume purchased will minimize the impact of supplier’s price increases.

Inventory protects against demand and lead-time uncertainties. For example, consider the problems which confront logistic system when both customer demand pattern and suppliers replenishment lead times are not known with a reliable degree of certainty. It follows that if service is to be maintained at acceptable levels to customers then an investment in ‘safety stock’ (as inventory) would be necessary.

Inventory also provides hedges against contingencies. For example, natural calamities such as cyclones, fires, floods, and other exogenous variables can create problems. To protect against these, one may be motivated to keep inventory.

**Imbalance in a Supply Chain**

Basically, the primary motive behind carrying inventory in a supply chain is to eventuate a balanced transaction between supply and demand. However, only when we have full information about the supply and demand side, we can eventuate a balanced transaction. In reality, the supply and demand side may take three states of nature. Depending upon the combination of the state of nature, the size and location of inventory are normally decided. The inventory in a given location in a particular supply chain acts like and engine flywheel, which acts as the balancing mechanism to meet the fluctuations resulting in either supply or demand side or both. In real life, things are not quite that simple. Indeed, the real key to
understanding inventory cost and service is to understand what causes imbalances in supply and demand in the first place.

**Supply/Demand uncertainties**
A cause of supply/demand imbalances is uncertainty. We will focus on demand uncertainty since it is arguably the dominant form of uncertainty in most supply chains, but similar ideas apply to supply uncertainty. Why does demand uncertainty cause a problem?

Because the demand process is uncertain, the demand on the inventory during the review period is also uncertain. If demand is weaker than expected, we can end the period with excess inventory; if demand runs unexpectedly high, we may end the period with significant number of back-orders. Note the periodic review introduces cycle stock, since we must order on average enough products to satisfy average demand in a period.

**Reference**


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1.3.4 Vendor Managed Inventory systems

In the traditional replenishment process, the customer has to create an order for the vendor at every step in the supply chain. The customer does not give prior notification of requirements which, means that the vendor is compelled to store safety stock that acts as a ‘buffer’ for all eventualities. The customers also have safety stock available of the same items as a protective mechanism in case they do not receive the required stock. This procedure leads to a larger amount of stock in the entire goods supply chain.

Through vendor managed inventory programs, manufacturers can offer their customers a value-added service by performing the replenishment-planning task for their business partners. Besides giving the manufacturer increased visibility into actual consumer demand, VMI also recognizes that often vendors may have better decision-support systems in place and more knowledge and control over the logistical processes. By increasing visibility into actual consumer demand as well as customers inventory levels, VMI programs allow manufacturers to make better decisions on how to deploy goods across various customers, which leads to increased customer service levels, lower transportation costs, reduced inventory levels and lower sales cost. Both parties benefit from reduced cycle times and lower overhead, since the process can be highly automated. With VMI, the vendor specifies delivery quantities sent to customers through the distribution channel using data obtained from EDI.

Vendor Managed Inventory, Just-in-Time Distribution (JITD) and Efficient Consumer Response (ECR) all refer to similar concepts, but applied tend to use ECR, whereas the automobile industry tends to use VMI and JITD. VMI reduces stock-outs and reduces inventory in the supply chain.

Some features of VMI include:

✓ Shortening of the supply chain
✓ Centralized forecasting
✓ Frequent communication of inventory, stock-outs, and planned promotions. Electronic Data Interchange (EDI) linkages facilitate this communication.
✓ Trucks are filled in a prioritized order. For example, items that are expected to stock out have top priority, then items that are furthest below targeted stock levels, then advance shipments of promotional items (promotions allowed only in transition phase), and finally items that are least above targeted stock levels.
✓ Relationship with downstream distribution channels.

Result of VMI is inventory reduction and stock-out reduction.

Challenges of VMI implementation

VMI can be made to work, but the problem is not just one of logistics. VMI often encounters resistance from the sales force and distributors. Some issues are roles and skills, trust, and power shifts. Some of the sales force concerns are

✓ Loss of control
✓ Effect on compensation – incentive bonuses may depend on how much is sold, but sales force has less influence under VMI.
✓ Possible loss of job
✓ Skepticism that it will function well – technical problems.
✓ Concern that reduced inventory will result in less shelf space and therefore loss of market share. This concern can be addressed by filling the shelf space with other stock-keeping units from the same vendor.

Distributors also may have concerns about vendor managed inventory, including

✓ Inventory will be pushed on them.
✓ No more promotions, discounts, and forward buying.
✓ With fewer inventories, more risk of disruptions due to strikes, adverse weather, etc.
✓ The vendor enjoys the benefits while the distributor gives up its only lever of power – data on what the retailers want.
✓ Danger of being replaced – vendor may decide to forward integrate.

For a VMI system to work, the concerns of distributors and the sales force must be addressed. They can be at least partially addressed by the following

✓ Transform the sales role into one of marketing. For example, bonuses can be given based on the number of new clients.
✓ Distributor skepticism can be addressed by implementing a pilot program with vendor-owned warehouses in order to demonstrate that the system works. Introduce system in distributor-owned warehouses on a pilot basis.
✓ Engage a neutral consultant in meetings among the vendor, distributor, and sales force.
✓ Allow some manufacturer promotions in the transition.
✓ Extensively simulate the system off-line before implementing.
✓ Don’t exaggerate the benefits of VMI; otherwise, any delay in realizing the benefits may cause the supply chain to lose faith in the system.

The aim of Vendor-Managed Inventory (VMI) is to integrate key customers in supply chain planning. It is particularly advisable to implement VMI in the following circumstances

✓ If key customers constitute a high percentage of the vendor’s sales figures, if the products are standardized and requested repeatedly.
✓ If product growth is not excessive, meaning that the requirement patterns are stable and one can assume that requirements will not occur spontaneously.
✓ If the transaction costs for order processing and production planning are high.
Inventory performance measures

Performance measures are recognized as an improvement element. Managers and supervisors directing the efforts of an organization or a group have a responsibility to know how, when and where to institute wide range of changes. These changes cannot be sensibly implemented without knowledge of the appropriate information upon which they are based, and there is currently no standardized approach to developing and implementing performance measurement system. Performance measures quantitatively tell something about products, services and the processes that produce them. They are a tool to help understand manage and improve what organizations can do.

Customer service and satisfaction are the two most important attributes in the supply chain. Enhanced competitiveness depends on factors such as: identifying the important measures of performance for a given strategy; understanding the inter-relationships of these measures; and focusing on measures which truly predict long term financial success of the business. The performance measures in supply chain should be encouraged based on negotiation between finance, sales, developments and manufacturing. In the design of performance measures the following considerations are to be kept in mind:

✓ The performance indicators must be realistic and representative, so that the gathered information reflects reality. The measurements must be performed consistently, in order that they are defined and quantified in the same way throughout the entire supply chain.

✓ The performance indicators must relate to the commercial and distribution process between producer and customer. The performance indicators should not only be expressible in physical units, but also in financial terms. The performance indicators must be able to make costs transparent and to provide a basis for investment decisions. The performance indicators must reflect the responsibilities of the managers involved in the supply chain.
There are a number of indicators that suggest to management that inventory management techniques could be improved. Some of these indications are:

- Increasing customer and distribution complaints accompanied by a high rate of customer and distributor turnover and order cancellation.
- Increasing level of stockholding and decreasing stock turn performance
- Increasing level of backorders
- Periodic excesses and shortages of storage space
- Increasing level of stock obsolescence
- Increasing investment in dead/slow items
- Increased space used by dead/slow items

In order to maintain the inventory investment at a cost-effective level, a number of measures should be introduced. These are financial and operational performance features

- **Financial Performance**
  - Return on inventory investment
  - Inventory investment/working capital investment
  - Percentage of inventory increase (decrease) versus percentage of sales increase (decrease)
  - Percentage of inventory increase (decrease) versus percentage of cost of sales increase (decrease)
  - Stock ‘write-off’ per period
  - Level of capital consumed by dead/slow items

- **Operational Performance**
  - Customer service levels over time
  - Inventory turnover performance; product groups, region wise, rate of sales categories, etc.
  - Inventory accuracy; actual count/indicated
Number of customers not supplied from stock
Number of units out of stock/number of day’s product/segment wise
Number of stock outs per year (or other significant period)
Profitability of stock out/product groups, rate of sale categories, etc.
Percentage of demand supplied from stock

**Inventory turnover ratio (ITR)**

Inventory turnover ratio (ITR) is defined as the ratio of Cost of Goods Sold from stock sales during the year to the Average Inventory Investment during the year. While considering, ITR only consider cost of goods sold from stock sales, which are filled from warehouse inventory. Non-stock items and direct shipments are not included. The cost of goods sold includes transfers of stocked products to other branches and quantities of these products used for internal purposes such as repairs and assemblies.

As one determines inventory turnover goals, consider the average gross margin one can receive on the sale of products. Most distributors who have 20% - 30% gross margins should strive to achieve an overall turnover rate of five to six turns per year. Distributors with lower margins require higher stock turnover. If a company enjoys high gross margins, one can afford to turn inventory less often (which may be difficult to realize in these days of competitive scenario).

A turnover rate of six turns per year doesn’t mean that the stock of every item will burn six times. The stock of popular, fast moving items should turn more often (up to 12 times per year). Slow moving items may turn only once or not at all. The ITR is calculated separately for every product line in every warehouse. This will allow one to identify situations in which inventory is not providing an adequate return on investment. To improve inventory turnover, consider reducing the quantity one normally buys from the supplier. ITR will improve when one buys less of product, more often. Thus in JIT the ITR will be high.
**Framework of performance indicators**

The framework within which the performance indicators in supply chain are described is based on the hierarchical structure. In this framework, a hierarchical categorization is made, using an increasingly detailed description (Figure 3). The performance is evaluated on five important links of the supply chain management system: (a) Inbound logistics, (b) manufacturing, (c) Outbound logistics, (d) marketing and (e) service after sales. These links are to be evaluated on the following metrics:

- Quality
- Inventory
- Customer service
- Cost
- Flexibility
- Time
- Productivity

<table>
<thead>
<tr>
<th>Inbound Logistics</th>
<th>The link between supplier and operations is provided by the inbound logistics. The inventory policies for raw material, their location, transportation etc., will decide the strength of inbound logistics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>The operations functions will include evaluation of facilities, WIP inventory policies and communication within the operations domain.</td>
</tr>
<tr>
<td>Marketing/Sales</td>
<td>This will include the dealer network, sales strategies (workforce, advertisement campaign, etc.)</td>
</tr>
<tr>
<td>Outbound Logistics</td>
<td>This will include logistic from plant to customer via distribution channel and will cover issues like transportation, inventory and distribution network comprising ware houses, deports, etc.</td>
</tr>
<tr>
<td>Service after Sales</td>
<td>This function will evaluate the most important element in the supply chain: Customer. This relationship will be evaluated based on flexibility, terms of payment, quality of service, after sales, etc.</td>
</tr>
</tbody>
</table>

Figure 3-Various Links in the SCM
At the next level, the performance of a specialized function or department is analyzed within each link. Functions, which can be considered for the producer, wholesaler and retailer, are for instance, a purchasing function, a distribution function and a marketing or sales function. A department in a company is regarded as the customer of another department. These performance indicators are useful at a tactic level. At this level, the performance of a subsystem within each function within a certain link is considered.

The supply chain function can be differentiated along other subsystems, namely the inventory control of finished products, the warehouse function and the transport function. At the next level the operational decisions are to be taken. At this most detailed level, the performance of each activity within a subsystem is considered. For the warehouse function, handling-in storage and handling-out are distinguished at this level.

For the external transport function, a categorization is made concerning the activities of loading, driving and unloading/waiting. First, the primary process that needs to be controlled is to be described and the system boundaries are to be determined. Second, the information that is necessary for the determination of the performance indicators is to be gathered and/or measured. In addition, the real performance indicators are to be compared with the planned performance indicators. If a variation between reality and norm is observed, these variations need to be analyzed and possibly corrective action should be taken.

**Reference**


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1.3.5 Transportation management in the Supply Chain

Transportation is the movement of products from one node in the distribution channel to another. By providing for the swift and uninterrupted flow of products back and forward through the distribution channel, transportation provides companies distinct markets on an equal footing. Transportation also permits wider and deeper penetration of new markets far from the point of production. In addition, by maximizing vehicle and materials handling capacities and cargo requirements, effective transportation permits distributors to leverage economies of scale by lowering the per unit cost of transporting the product.

Efficient transportation enables distributors to reduce the selling price by holding costs down, thereby providing for more competitive product positioning. Finally, transportation provides other business function with essential information concerning products, marketplace and time utilities and transit costs, and capabilities necessary for effective enterprise planning and operational execution. The first step in the transportation management process is to establish the cost effectiveness of private transportation fleets and the search for and selection of public carriers. The goal is to ensure the highest level of customer service at the lowest possible price. The second step involves the ongoing choice of selected transport mode to meet daily transportation requirements. Modes should be chosen that will perform the service for the cost, satisfy any special needs required by the customer, exceed the rates and services offered by competing carriers and minimize the likelihood of loss, damage or delivery delay.

Once the mode and carrier has been selected, suppliers as a third step must work with carriers to establish an effective schedule and the proper vehicle routing to ensure timely customer delivery. The fourth step of the process is the preparation and completion of the necessary transportation documentation. Finally, managers must be diligent in developing transportation performance measurements that will
provide them with quantifiable data necessary for increased productivity and competitive advantage.

**Strategy**

Transportation is a very key element of the logistics process and the supply chain which runs from vendors through operations to the customers. It involves the movement of product, service/speed and cost, which are the critical issues in effective logistics. It also impacts with the other two logistics – movement of information and integration within and among suppliers, customers and carriers. A transportation strategy, to be effective in supply chain management, is not one carrier against another. It is not negotiating down rates. Rather it is a way to respond to the dynamics of the business, its customers, suppliers and operation function.

The strategy, must acknowledge the following elements

- **Customer requirements**: The supply chain involves continuous and efficient movement of product from vendor to manufacturer to customer. Therefore the transportation program must reflect and meet the customer’s needs. The time and service aspects of transportation are vital.

- **Timely delivery**: Customers demand their supplies be delivered as they require – on the date needed, by the carrier preferred, in the proper packaging method and delivered good order. Being able to have a transportation program which can do this provides customer satisfaction and can give an organization a sustainable competitive advantage.

- **Mode selection**: How to move the product, i.e. by air versus surface? What roles do transit time play in supply chain? How will the inventory and service impacts be measured as compared to the freight charges?
Carrier relationships: Volume creates carrier/forwarder attention. Even if you have no strategy, the number of carriers trying to meet with you will make you develop one. The carrier attention with volume creates a competitive interest in any business. But there is another side to this attention, business cannot be divided among many carriers. This may be due to the fact that as one fractures one’s business, the negotiating or leverage position is also affected and one will not be able to develop carrier alliances needed to meet the supply chain service requirements.

Measurement: One needs to evaluate how well the strategy and carriers are performing. This takes two approaches. One is measuring. Measuring means comparing performance versus standards. What is the actual delivery to customer performance, on a macro basis, carrier and customer-by-customer basis? A macro measure can hide a problem even if the overall measure is good. With integrated supply chain management, one is focusing on each customer and delivery locations. Costs should be measured. What is the total transport bill? How well it is being spent? Freight cost data tied with sales and transportation data makes a good database for budgeting and managing costs. It provides data for negotiations, developing good freight costs for sales and accounting, for studies and other purposes.

Benchmarking may help in this matter. Benchmarking means learning what other companies do – the best practices. Very often benchmarking is not done with a company in one’s industry. Competitors are not likely to share information. And best practices are not the exclusive of one industry or company.

Regulatory impact: Regulatory changes can change, for better or worse. This may affect the strategy formulation. The recent regulations in Delhi (and now in
Mumbai) about CNG vehicles have affected the transportation scenario in a significant manner.

- **Flexibility**: Change is happening. It is not a question of whether or not it happens. The only question is how quickly it occurs. The strategy has to be ready to change. New customers, New products, New businesses, New suppliers, New corporate emphasis, Each of these can dramatically change the way strategy is formulated and implemented, Accordingly, the transportation has to respond to these changes.

**Transportation selection**

Transportation selection decisions are not usually taken solely on minimizing per unit costs, but aim to reduce total logistics costs. Therefore, to optimize relationships with forwarders, shippers need to employ supply chain management processes to co-ordinate their operations with all parties in the chain.

- **Responsiveness**: Due to the importance of time-based competition in today’s JIT oriented markets, responding to customer requirements quickly enables the traditional service-cost trade-off to be eliminated. To achieve this time compression, the agile approach is gaining much recognition – examining the supply chain from the customer’s viewpoint, transferring information back to decision-makers at all levels. Accordingly, the SCM is embracing the concept of “tailored” or segmental logistics. This means different groups of customers have different logistical requirements and need policies tailored to their needs. Hence, transportation is a crucial component of agility providing the time-specific links between assembly lines and customers.

However, the performance capabilities of transport modes and operators are not sufficient. When information precedes the flow of physical stock, companies can achieve more consistent throughput. It has been stated that it is throughput,
not speed per se, which minimizes cost. Accordingly, the product moves through the supply chain through a seamless process without stopping.

- **Reliability**: Shorter transit time result in lower inventories, while more reliability causes lower stock-out costs. Consequently, if the transit time is not consistent, the customer must increase inventories above the level that a consistent transit time would require. The extended lead times involved in long sea passages are forcing companies to use the more expensive air freight option, but in the context of inventory holdings costs, potential lost revenue and market flexibility, the increased freight charge may be a worthwhile expense. To achieve the benefits of a reliable transport operation, there is agreement that closing the “lead-time gap” is vital.

- **Relationships**: The traditional functional approach to transport has resulted in firms separating demand-generation activities, such as advertising and promotion, from supply activities, such as manufacturing and transport. However, there is an agreement that this separation has allowed transport management to remain focused on functional efficiencies in isolation from benefits derived from integration with the rest of the supply chain.

**Modes of transportation**

Carriers vary considerably in their characteristics. Speed ranges from the supersonic in the air to a leisurely 5-10 kilometers per hour by river route. Shipments can vary in size from 150 tons in a rail to only 10 tons transported by truck. A broad spectrum of equipment is available depending on the type of products carried. Prices also vary, as do the types of service offered. The supply chain manager, thus, has a lot to think about while selecting a mode of transportation for the products. The following issues need to be resolved.

- Negotiating rates and routes.
- Selecting routes and carriers.
Appearing before regulatory agencies to support or protest a change in rates affecting the company.

Evaluating carrier performance.

Analyzing transportation costs and services.

Operating company-owned means of freight and passenger transportation.

Filling loss and damage claims.

Auditing freight bills to ensure that the proper charges were paid to carriers.

Carriers can be grouped into the following major categories:

- Common carriers, which hold out their services to all who wish to use them.
- Contract carriers, who haul freight for individual companies on a contract basis.
- Private carriers tend to be the most closely regulated by public authorities, contract carriers less so, with private and exempt carriers enjoying the most freedom from economic regulation.

All types, however, must observe the laws and regulations governing safety.

Rail: Rail has pride of place in the history of transportation of almost every country of the world. One of the major advantages of rail is the ability to haul large quantities of products over long distances. Several technological innovations in recent years have greatly improved rail service. For example, cold carriages were introduced by Indian Railways to carry refrigerated items. These innovations are especially helpful considering the type of product carried on most rail shipments.

 Majority of all the freight hauled by rail is coal. Another major class of goods consists of agricultural products. Any important improvement in service eventually translates into rupees saved through lower freight rates and less costs to shippers in better handling of their products. The rail, of course, is not without its problems. When revenue runs low, economies are obtained in
operating costs by slighting the maintenance of way and equipment. Still, rail reigns supreme as an economic and efficient hauler of bulky items over long distances.

Motor Carriers: Motor carriers can be divided into categories according to their legal status:

- **Common carriers**, who must serve all who ask their services (provided, of course, the carrier has the necessary equipment).
- **Contract carriers**, who haul freight for individual shippers under specific written agreements.
- **Private carriers**, who own the freight they haul.
- **Exempt carriers**, who haul farm products, fish or livestock, or who operate within the confines of a single city. Note that any carrier becomes exempt while hauling the named products.
- **Brokers**, who own and operate no equipment but bring together those who wish to ship freight and those who wish to haul it.

Oil Pipelines: Not all pipelines, of course, carry petroleum products. Slurry pipelines, for example, carry a pulverized product (such as coal or grain) suspended in water, while the natural pipelines supply our furnaces and air conditioners. Pipelines are not especially fast and, in fact, rank last in speed of the major modes of transportation since they move their content at less than five miles per hour.

One of the major issues in pipeline transportation is shrinkage of the product, due mostly to evaporation. Crude petroleum can lose up to one-quarter of a percent of its volume in transit through the line, while a refined product such as petrol or kerosene can lose up to one percent. Another problem is the sheer size of the investment required to build the line.
Water Transportation: Water transportation within the nation travels along the rivers and canals. Speed is slow and made even slower when ice or floods clog the waterways; but water can carry large bulky cargoes. This bulk cargo consists mainly of coal, petroleum, grain and iron ore. The capacity of some modes of water transportation is quite large. Weather presents a continuing problem. Ice can bring shipping to a complete halt, thus requiring companies that rely on water transportation to maintain enough inventories on hand to last through the icing season. Storms can be sudden and severe enough, with savage winds and high waves, to sink heavily laden vessels.

Air Transportation: Air freight has never enjoyed the glamour accorded to passenger aircraft, although many passenger airplanes are able of handling a considerable amount of freight in the cargo holds beneath the passenger compartments. Many jet aircraft can function in a dual capacity. Air, by whatever type of airline, is generally considered a premium means of transportation. Air transportation is fast, but the freight rates are correspondingly high. Unless speed is an important factor in delivering parts to prevent the shutdown of an assembly line or to meet a delivery date to a valued customer, some less expensive means of transportation will usually suffice.

Other Modes of Transportation: Other modes of transportation include the freight forwarder who accepts small shipments and charges less carload (or less truckload or less planeload) rates and consolidates the small shipments into carload truckload, or planeload lots, which are then sent by the lower quantity rates. Frequently, the freight forwarder acts as a traffic department for small companies, which usually ship in less carload lots. Shippers’ cooperatives offer much the same services as the forwarder in consolidating small shipments into larger ones, except that the profits of the business are returned to the members of the cooperative. Small packages can also be sent via speed post, and can use some of the expedited delivery services the Indian Post System now offers.
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1.3.6 Customer relationship management (CRM) strategy

CRM-as a new approach, a new technique, a new management concept for managing customers – focuses a business on creating a technological environment that integrates marketing, sales, service and back-office and supply chain functions in order to allow an enterprise to take a 360-degree view of its customers. CRM fosters an environment where the automation of customer-facing processes and the integration of historically isolated customer databases help a business to focus on doing business with the right customers. At the same time, a business can provide personalized, individualized attention-regardless of who the customer is interacting with or where that employee resides within the business. This is CRM strategy.

As we mentioned, CRM is the new management concept that relies heavily on technology and process automation to create its environment. However, to create such an environment will entail change: change in processes; change in people; change in technology; change in management styles; and the change in the overall way a business looks at and conducts business with its customers. Introducing this level of change into any business can create turmoil among employees if not introduced and implemented carefully and with a purpose. In order to bridge a gap between the elements of CRM that have been discussed into actual daily use, a new type of customer champion, a “customer leader”, is needed. Therefore, for supply chains to become strategic; the following elements are necessary:

- **Technology:** The customer relationship in the supply chain must be a champion of technology. Leaders and businesses that do not aggressively permeate the entire organization with information technology will increasingly inhibit their frontline employee’s ability to manage customer relationships effectively. We are entering a new era in which total customer care transitions from slogan to reality, a reality enabled by advancements in infrastructure technology (internet, EDI) that connects the various systems and databases associated with managing
the customer from “cradle to grave”. In doing so, front-line employees are being empowered through up-to-date and comprehensive information. Combining information access technology with online analytical processing tools and knowledge, employees are becoming a potent recipe for delivering total customer satisfaction and loyalty.

From a customer’s perspective, effectively identified and implemented technology can help employees directly match customer desire for customization in the product and services they seek and provide after-sales service and support based on customer profile data. From a business standpoint, technology can help identify the most valuable customer relationships and equipped employees with abundant and relevant information about those customers in order to provide most effective sales and service.

In effect, SCM technology can integrate the enterprise, fostering an environment of shared customer knowledge and focusing the right employees on serving the right customers. The new leader recognizes that SCM technology is strategic. SCM technology must become a central part of the performance equation. An effective leader will ensure that SCM technology is embraced by the entire organisation to drive its overall success in term of: reducing supply chain costs; improving product margins; lowering inventories; increasing manufacturing throughput; and maximizing returns on assets.

- **Organizational Environment**: Most observers of modern organizations agree that the global reach and speed of modern business demands a more decentralized approach to decision making. Focusing the right employees on the right customers will be critical to fulfill a SCM vision. Placing top employees with the top customers creates a synergetic environment of achievement and fulfillment, thus aiding in the struggle to retain top talent. In short, customer-interacting employees that work in a localized atmosphere of
action will be advantageous position to directly meet customer’s needs for personal relationships.

➢ **Atmosphere of Innovation**: Innovation allows companies to race ahead of competitors and thus builds costly competitive entry barriers that discourage competitors. Creating an atmosphere of innovation is direct result of an environment that encourages entrepreneurial thinking at the local level. A forward-thinking customer relationship leader fosters an atmosphere of innovation and encourages employees to remove barriers that inhibit effective SCM.

Innovations in SCM must lead in the following dimensions:

- Reduced inventory at all sites of the supply chain.
- Reduced costs.
- Faster processing speeds.
- Reduced lead times.
- Reduced warehouse costs.
- Reduced obsolescence.
- Greater responsiveness to customer changes.
- Electronic links to customers and suppliers.
- Continuous flow of products and information.
- Speeding up the development cycle.
- Continuous flow (not overload).

One of the best ways to gather relevant data about customers is to ask questions in a brief survey. Your overall goal is to find out how satisfied your customers are and whether they would recommend you to others. This information can be obtained by various means, such as a paper form, a website survey or an e-mail. Try to minimize survey questions to get the best possible participation. Consider providing an incentive for answering a survey--for instance, the chance to win one
of your products. Have a plan for aggregating the data collected so it can be sliced and diced in various ways and integrated into your customer database.

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1.3.7 Information Technology in Supply Chain

The focus of management has changed over time. Earlier, strategic planning and product portfolio approach drove business thinking. Success depended on the ability an organization to meet demand at the lowest cost, leading to an “economies of scale” approach. The 80s exposed the weakness of this approach and saw an upsurge in quality consciousness, leading to an increased emphasis on TQM, product reliability and customer satisfaction.

In recent years conducting business has become increasingly complex. The various factors leading to this development are increasing product variety and volumes, increasing competition, shrinking product life cycles and growing customer demands. To manage this complexity effectively on a real-time basis for a business, information sharing across functions and locations has become critical. Flexibility and responsiveness have become key business drivers forcing business to orient themselves along process instead of functions. It is in this aspect of management that the use of information technology assumes a greater significance in managing the supply chains.

Supply chain management, enabled by advances in technology, aims to develop an effective infrastructure linking technology and people, in an effort to align advances in information technology with the capability of the organization for facilitating customer satisfaction. This integration is aimed at leveraging information tools to address the following business concerns: Flexibility and variety, quality, responsiveness and edging toward agility.

One of the main objectives is to increase the efficiency and effectiveness of working so that we get quantum improvements in performance measures. In this scenario, IT through automation and computerization plays an important role. Rapid developments and diffusion of IT through computers and telecommunications have enabled changes in various facets of life. What was not
feasible in the past, has become feasible today due to technological innovation. For example, dramatic reductions in technology costs (e.g. low cost of PCs and networking) have resulted in the proliferation of computer power throughout the organization and a trend towards the decentralization of information resource. This has resulted in new possibilities and opportunities for the effective functioning of organization to support organizational objectives. IT can be perceived as the set of task that encompasses structure, processing and communication of information. It also includes the manner in which these resources are organized into a system capable of arranging out a task or set of tasks.

We visualize that IT will impact the following sub systems:

- **Planning** is concerned with the setting of objectives and establishment of standards for every objective. In order for planning activities to be carried out, relevant information needs to be collected, organized and stored. IT can be used to facilitate the acquisition, organization and strategic use of information as well as provide support for diagnosis and forecasting.

- **Monitoring** is concerned with observations of behaviors and measurements of outputs to ensure compliance with standards. Since monitoring is usually labour intensive, the use of IT support in monitoring activities can reduce administrative levels by enabling greater span of control. IT enables better control of resources, the use of IT in automation (bar coding, etc) would produce significant increase in productivity. With the use of IT, there would be less need to monitor.

- **Evaluation** is concerned with assessment of the performance of individuals or groups against pre-established goals and standards. Administration needs to evaluate not only the effectiveness of current strategies but also the changes in environment that can influence strategy.
**Typical IT solutions**

The developments in IT have resulted in many possible alternative solutions for managing the supply chain effectively. Some of the major developments in IT which are transforming the supply chains today are as follows:

- Electronic Data Interchange (EDI)
- Intranet/Extranet
- Data warehouse/Data mining/Data marts
- e-commerce/e-procurement
- Bar Coding Technology
- Other technologies (such as Smart cards, Radio Frequency Identification Device (RFID), etc)

<table>
<thead>
<tr>
<th>IT Element</th>
<th>Operation</th>
<th>Results in</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDI</td>
<td>Inter-organizational exchange of business documentation</td>
<td>Reduced transactions costs and time. Optimize inventory. Improved decision making. Increase accuracy. Improved customer service.</td>
</tr>
<tr>
<td>Intranet</td>
<td>Distribution of information within an organization</td>
<td>Common process for multiple functions. Two-way communication between different parts of the plant.</td>
</tr>
<tr>
<td>Extranet</td>
<td>Information transaction among the clients, partners, customers and suppliers.</td>
<td>Enhance overall performance. Real time feedback.</td>
</tr>
<tr>
<td>E-commerce/e-procurement</td>
<td>Information related to cash cycle, accounts payable/receivables, etc.</td>
<td>Create new revenues streams and grow sales. Trim both transactional and overhead costs. Improve customer service and satisfaction. Increase return on Capital investment. Elimination of paper work. Elimination of some intermediaries.</td>
</tr>
</tbody>
</table>

Figure 4- Benefits of various IT elements
Information Technology has helped in making the supply chain faster, flexible and responsive. An organization needs to invest in IT carefully to make its supply chain more responsive. Various flows in supply chain such as material, information and money can be effectively managed through IT. Specifically

- Strategic decisions on supply chain design can increase customer satisfaction and save money at the same time – a classic win-win situation.
- By sharing information, supply chain partners are able to respond more rapidly to known demand and to do so with less inventory in the system as a whole and hence at lower cost.
- Reduction of operating costs by proper coordination of the planning of various stages of the supply chain is enabled through IT.
- By minimizing the need for excess parts and simplifying the overall design, it will be easier for companies to customize or vary the product according to each customer’s needs and requirements.
- Rapid introduction of new or modified product is possible through IT.
- Greater product customization, or manufacturing to order, would come at relatively low unit cost through IT.
- There is sharing of planning and scheduling information due to collaboration and integration among departments within the company and outside departments, something that is highly correlated to supply chain performance.
- Effective inventory management, having just the right amount of the right merchandise on the shelves for the just right amount of time, minimizes overstocking and markdowns, and so boosts profitability. This is possible through IT.

E-procurement makes the supply chain leaner, faster and responsive. The requirement is of matching technology, market initiative, consumer confidence and maturity and developing a regulatory framework for such solutions to mature. This
can bring a revolutionary change in the way business is done in that consumer has access to all the manufacturer/suppliers at his desktop/ palm top/mobile and the manufacturer has an instantaneous access to all the consumers irrespective of geographical boundaries.

**Reference**


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1.3.8 Supply Chain strategy and performance measures

A firm’s supply chain strategy should ensure that its supply chain provides superior value to the end customer in an efficient manner. Value offering (bundling of goods and services) to a customer should be available at a reasonable price. In almost all product categories, customers want more variety and quicker services at lower prices. Firms must recognize the nature of trade-offs between customer service and costs and arrive at an optimal decision on this front. If various processes and decisions within the chain are not aligned to suit a company’s business strategy, it obviously cannot remain competitive in the long run. The firm has to understand the relationship between business strategy and supply chain decisions and how different business environments pose different kinds of challenges to the supply chain.

Although at any given point managers need to understand customer service and cost trade-offs, in the long run firms will have to find a way of improving performance on both cost and service fronts. Because of the nature of competition, customers will demand better services at lower prices over a period of time. Progressive firms resolve this paradox through various supply chain innovations. To enhance supply chain performance, firms have to identify the right kind of initiatives to help improve both costs and customer service simultaneously on an ongoing basis.

Supply Chain responsiveness

Responsiveness captures the firm’s ability to handle the uncertainty of market demand. In addition to delivery lead time, supply chains have also been characterized on the basis of the nature of demand uncertainty faced by products in the market place. Based on the nature of demand uncertainty, products can be classified as functional products or innovative products.
Functional products (grocery) are those that satisfy the basic needs of a customer and therefore have low variety, stable and predictable demand, long life cycles and low profit margins. Innovative products (fashion and technology products) are those that try to satisfy a broad range of customer’s wants and have the following features: high variety, unstable and very-hard-to-product demand, short life-cycles, high profit margins and frequent stock-outs and markdowns.

Most firms often fail to take this into account when they introduce changes in their product lines / offerings. For example, firms operating in the innovative products space would have usually started their business with functional products and therefore would have focused on logistics efficiencies. As they grew, they would have introduced innovative products to compete effectively in the market but may not have changed their supply chain structure and processes. This would naturally result in a mismatch between the product characteristics and the supply chain.

As shown in Figure 5, firms must ensure an appropriate match between the type of supply chain and the nature of product characteristics. Demand unpredictability could occur either on the volume side or on the product-mix side. In some instances, it is difficult to estimate the overall volume is predictable but predicting demand at the individual variant level is extremely difficult, leading to product-mix uncertainty. For example, when it comes to new technology products, firms face volume uncertainty.

While in the case of some innovative products, where the overall category is at a mature stage (garments, jewellery), firms usually face product-mix uncertainty. Within the life cycle of products, they are likely to face high volume uncertainty at the growth stage. Thus, during the growth stage firms need to work with responsive chain, and over a period of time, at the mature stage, firms required an efficient chain.
For innovative products, like fashion products, demand is inherently unpredictable at the final customer end. Risk mitigation strategies involve buy back contracts, postponements or innovations in a supply chain design that enhance flexibility. So far we have focused our attention on demand uncertainty.

However, a firm could also face uncertainty on account of supply in the chain. Unlike demand uncertainty, supply uncertainty has not received enough attention in supply chain literature. Unlike demand, a firm can exercise greater control on supply and the popular view was that uncertainty in supply can be handled by choosing appropriate partners in a chain. Thus, traditionally, the focus has been on supplier selection and supplier development rather than on the management of supply uncertainty. The terrorist attack in September 2001 forced firms to look at their supply chain vulnerabilities, and firms have realized that they need to focus on both demand uncertainty and supply chain disruptions. Managing supply chain disruptions involves managing certain events that have a low probability of occurrence but have a high impact on supply chain performance.

**Delivery reliability**

Delivery lead time is an important dimension of customer service, and delivery reliability essentially captures the degree to which a firm is able to service its customers within the promised delivery time. Delivery reliability measures the fraction of customer demand that is satisfied within the promised delivery lead
time. Given the nature of demand and supply uncertainty, it is obviously more expensive to provide higher levels of service. Essentially, firms have to trade-off inventory costs and stock-out costs to arrive at the optimum service level. In general, firms will have to arrive at an optimal trade-off between cost (costs related to high inventory and slack capacity) and service level while deciding on this issue. In the industrial products category, performance on the delivery reliability front is monitored and the supplier is usually chosen based on performance on this front.

*Product variety*

The quantum of variety offered by a firm is an important dimension of customer service. In the past couple of years, a “variety explosion” has taken place in most product categories. Higher product variety offers greater choices to the customer who is likely to get a product that fits closest to his or her actual requirements. Some firms like Dell Computers and National Panasonic go to the extent of allowing their customers to design their own products. Obviously, higher variety would lead to greater complexity, resulting in higher supply chain costs. Some firms have found that variety explosion has affected firm profitability in an adverse way. Firms like P&G have worked on product rationalizations and have reduced overall product variety. While deciding the optimum level of product variety, a firm has to manage trade-offs with other dimensions of customer service like order lead time.

*Supply Chain performance measures*

Among various sets of supply chain performance measures discussed in the literature, we focus on a set of performance measures that have been most widely accepted in the industry. Supply chain performance measures fall under the following four broad categories:

- Cost
- Assets
Supply Chain Performance Using Financial Data

Though supply chain benchmarking has received much attention, we have found that firms face multiple sets of problems while carrying out this exercise. Most firms suffer from the problem of data availability. Even if the relevant data are available, one is not sure of the validity and reliability of the data. It is difficult to get financial databases that are reliable.

One can calculate the 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.

- **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.

- **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.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CRM</td>
<td>Cost of raw material</td>
</tr>
<tr>
<td>CP</td>
<td>Cost of production</td>
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<tr>
<td>DC</td>
<td>Cost of distribution</td>
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<tr>
<td>CS</td>
<td>Cost of sales</td>
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<tr>
<td>NS</td>
<td>Net sales</td>
</tr>
<tr>
<td>INV</td>
<td>Inventories (inclusive of raw materials, semi-finished goods and finished goods)</td>
</tr>
<tr>
<td>RM</td>
<td>Raw materials inventory</td>
</tr>
<tr>
<td>SFG</td>
<td>Semi-finished goods inventory</td>
</tr>
<tr>
<td>FG</td>
<td>Finished goods inventory</td>
</tr>
<tr>
<td>AR</td>
<td>Account receivables (excluding loans &amp; advances)</td>
</tr>
<tr>
<td>AP</td>
<td>Account payables</td>
</tr>
</tbody>
</table>

Figure 6 - Data to be used from financial statements
1. Calculating length of various stages of the chain

The following formulae are used to calculate the length of the various stages in the supply chain:

\[ \text{DRM, DWIP, DFG} = \text{Days of raw material, work in process and finished goods}, \] respectively

\[
\begin{align*}
\text{DRM} &= \text{RM} \times \frac{356}{\text{CRM}} \\
\text{DWIP} &= \text{SFG} \times \frac{365}{\text{CP}} \\
\text{DFG} &= \text{FG} \times \frac{365}{\text{CS}}
\end{align*}
\]

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

The duration of time taken by the material flow is captured by this measure. Firms like Dell Computers perform very well on this dimension.

2. Evaluating The Efficiency of Supply Chain Management

The internal supply chain inefficiency ratio is measure of the efficiency of internal supply chain management. To calculate this ratio, we consider total inventory carrying costs and the distribution costs to be components of the internal supply chain management costs. We calculate the internal supply chain inefficiency ratio as follows:

\[
\begin{align*}
\text{SCC} &= \text{DC} + \text{INV} \times \text{ICC} \\
\text{SCI} &= \frac{\text{SCC}}{\text{NS}}
\end{align*}
\]

Where 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. In the absence of any data, one can work with an inventory carrying cost of 0.2. The supply chain inefficiency ratio (the lower the better) provides an insight into the internal supply chain management efficiency of the firm. This measure is termed the supply chain inefficiency ratio since the supply chain cost will be higher
if there are inefficiencies in the system. Firms with efficient supply chain systems will have relatively lower scores on this performance measure.

3. 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.

A firm can compare its own performance with that of its competitors and the industry aggregate in order to ascertain where it stands in terms of supply chain performance. Using benchmarking data, a firm can also map a supply chain profile that allows it to effectively capture both the dimensions of time and cost in one diagram. Further, a firm can also compare its own profile with that of its competitors in order to ascertain where it stands in terms of costs and length of time in the chain. Benchmarking is a useful tool for comparing the performance of competing firms so as to identify areas of improvement for further detailed investigation, which may lead to process improvements. Once a firm has identified gaps, it should try and carry out a process benchmarking exercise.

Linking Supply Chain and business performance

Any supply chain initiative that results in an improvement in some aspect of supply chain performance must ultimately get translated into improved business performance. In the final analysis, each firm is primarily interested in improving its return on assets (ROA). The impact of various supply chain initiatives can be estimated in terms of costs and benefits using the following broad groupings:
Cost reduction is achieved by
✓ Reducing inventory
✓ Reducing logistics expenses
✓ Reducing direct material expenses
✓ Reducing indirect material expenses

Improving revenue and profitability by
✓ Selling higher margin products
✓ Achieving higher market share
✓ Reducing backorder and lost sales
✓ Attracting new markets
✓ Decreasing supply time to market

Improving operational efficiency by
✓ Reducing procurement expenses
✓ Increasing assets utilization
✓ Delaying capital expenditure

Reducing working capital by
✓ Reducing inventory
✓ Reducing accounts receivables

Finally, what we need is a single framework to integrate various related costs and benefits.

Enablers of Supply Chain performance

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

1. **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 inter-firm transactions. Companies are realizing that they can replace physical inventory by information. To really exploit their IT investments, companies need to re-engineer their supply chain and other supporting organisational processes and try to replace physical inventory with information.

Unfortunately, many Indian companies have invested in information systems have not made the corresponding changes in their supply chain systems and processes, which has resulted in the company failing to exploit the information system to its full potential. 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.

Similarly, on the order-processing side, companies can offer greater customization as compared to the past because their order-processing system can be designed to handle 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. But unfortunately a significant number of companies have used IT to just automate the existing supply chain systems and processes. Companies
that have successfully exploited IT have made major changes in their supply chain structure, systems, processes and strategy.

2. **Entry 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. Apart from bringing in the much needed professional to the field, 3PL companies have economies of scale as they are able to pool demand across customers. In developed markets, global firms would like leading 3PL companies to go beyond the traditional role and 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.

Currently, the 3PL industry in India is still in its infancy. Two sets of companies have emerged in this field. One set of companies involves traditional transporters, shippers, warehouse service providers and freight forwarders, who want to offer value-added services and would like to see if they can develop competencies and become a 3PL company. The second set of service providers comprises international 3PL companies that have come to India along with their global MNC customer. For example, when 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.

Currently, not many companies in India employ the services of other 3PL companies. However, with the evolution of the Indian market, new MNCs and progressive Indian companies operating in the mid-volume, mid-variety segment have started using the services of 3PL companies. Over a period of
time, the 3PL companies would not only develop the competence required to function smoothly in the Indian context but also take care of the logistics requirements of the bulk of the industries in India as well.

3. *Enhanced Inter-firm Coordination Capabilities*: Successful coordination across a global network of companies has been a comparatively new phenomenon in the corporate world. It has been realized that for a network to function meaningfully one needs a firm to play the role of the strategic centre. Many companies, like Nike, Benetton, Nintendo, Sun and Toyota, have successfully managed complex networks, played the part of the strategic centre and hence, have emerged as role models to other companies.

While each company in the network focuses on its core competencies, the strategic centres 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. The industry is still on the learning curve in this matter, but better understanding and coordination of issues would greatly help in diffusing the third supply chain revolution across all industries.

**Reference**


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