Block

5

CONTEMPORARY ISSUES IN SUPPLY CHAIN MANAGEMENT

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Our E-mail id: cwfeedback@icfaiuniversity.in

Centre for Distance and Online Education (CDOE)
The ICFAI Foundation for Higher Education
(Deemed-to-be-University Under Section 3 of UGC Act, 1956)
Donthanapally, Shankarapalli Road, Hyderabad- 501203

BLOCK 5: CONTEMPORARY ISSUES IN SUPPLY CHAIN MANAGEMENT

Among various organizational activities, supply chain management seems to have attained importance especially due to the impact of technologies, climate change concerns and the need for competitive advantage.

Supply Chain Management (SCM) appears to be one of the most disrupted area, mostly because of the significant impact of emerging technologies. Efficiency of supply chains started deciding the competitive position of an organization. Above all, interventions in supply chain management are to ensure sustainable and profitable operations to remain in business. All these topics are covered in this block consisting of four units.

Unit 17*: Information Technology in Supply Chain:* The single most important factor that revolutionized the area of supply chain management is massive application of information technology at all stage of the supply chain. All such interventions are detailed in this unit.

The concepts covered in this unit include the value of information flow in a supply chain and the use of information in a supply chain, changing role of information technology (IT) in a supply chain and decision making, service-oriented architecture (SOA), electronic data interchange, internet technologies, enterprise resource planning (ERP), process of implementing an IT-enabled SCM system, identification of IT infrastructure etc.

Unit 18: *E-Business and the Supply Chain:* The advent of internet revolutionized supply chain management beyond recognition. E-commerce occupied the center stage in the supply chain management, enabling efficient operations through enhanced speed, quality, flexibility etc.

This unit discusses such concepts as the impact of internet and e-business on supply chain in terms of costs and the types of e-business applications like e-procurement, e-collaboration; implementing the e-business proposition etc.

Unit 19: *Financial Flow in Supply Chain:* The efficiency of the supply chain and the profitability of an organization are dependent upon seamless financial flow in a judicious manner. The elements of such financial flow are discussed in this unit.

The unit explains such concepts as components of financial flow in a supply chain: automating financial flow, electronic invoice presentment and payment solutions credit information and management systems and integrating material and financial flow in a supply chain.

Unit 20: *Emerging trends in Supply Chain Management:* Supply chain management is changing at a breadth-taking speed. Technology development is faster in the area of supply chain management in view of its dominant role in an organization, whether it is manufacturing or servicing. Therefore there is a need to understand all such developments in supply chain management

This unit addresses these requirements through a number of related concepts such as supply chain eco-system and stakeholders, operations technologies like manufacturing intelligence, flexible manufacturing systems, modern shop floor; quality and productivity management, sustainability, occupational health and safety, environmental management, regulatory framework, innovation in SCM etc.

Unit 17

Information Technology in Supply Chains

Structures

"At least 40% of all businesses will die in the next 10 years… if they don't figure out how to change their entire company to accommodate new technologies."

- John Chambers, the former executive chairman and CEO of Cisco Systems

17.1 Introduction

Supply chains have many intermediaries and a lot of synchronous communication sharing and hand holding is critical for optimal services. Information technology is proving the best, and many time the only tool.

In the previous unit, we learnt about measuring supply chain performance. The concepts covered were overview of supply chain performance measurement (SCPM), framework for developing supply chain metrics, performance metrics and measures in a supply chain, requirements for designing an ideal SCPM system, and approaches to SCPM.

Effective supply chain management involves proper coordination of activities of the supply chain partners. For this, it is very important for them to share information. Otherwise, the supply chain cannot achieve its overall objectives of profitability and competitiveness. Often, members of a supply chain operate

independently, whether they are departments within a firm or a different firm. As a result, they have little idea of, whether they are collectively satisfying their customer's needs, as required. To ensure that the ultimate goals of the supply chain are met, it has to be information-driven. Both information sharing and the proper use of information received are critical to gaining a competitive advantage. The information collected from different members of the supply chain should also be analyzed properly, and decisions that improve the efficiency and responsiveness of the supply chain should be taken.

Information systems are used to make available relevant data and to share information between the partners in the supply chain. They also help in the analysis of the collected information and provide the inputs for managers to make informed decisions. IT systems consist of hardware and software that are used across the supply chain network for proper information flow and analysis.

In this unit, we discuss the value of information and the use of information technology in the supply chain. First, we examine the value of information flow in the supply chain. Later we discuss the use and evolution of information technology in the supply chain. This is followed by a discussion of various IT solutions that are used to manage the supply chain effectively. Finally, we look at the process of implementing an IT-enabled supply chain management system.

17.2 Objectives

By the end of the unit, you will be able to:

- Discuss the value of information flow in a supply chain
- Examine the use of information in a supply chain
- Establish the changing role of information technology in a supply chain
- Identify IT solutions for SCM
- Discuss supply chain management software
- Describe the process of implementing an IT enabled SCM system

17.3 Value of Information Flow in a Supply Chain

Uninterrupted information flow, between the members of a supply chain, can increase its efficiency and effectiveness dramatically. The flow of information between different stages in the supply chain can help them connect and coordinate with each other. Managers, working at different stages or levels, can also use information from across the supply chain i.e., from upstream and downstream members, through IT systems. Decisions made based on information obtained on a broader scale, are more likely to have a positive outcome. For example, a manufacturer can decide on production capacity and schedules based on information like lead-time and raw material availability from upstream suppliers, and details like inventory and customer demand patterns from downstream

distributors and retailers. Such decisions can be implemented without difficulty, by other members of the supply chain.

The effectiveness, of the decisions made by various supply chain partners, depends on the accuracy and relevance of the information, through the supply chain. While accurate information helps the manager to understand the position better, distorted information results in improper decisions. With increasing advances in information technology, firms today face an information overload, i.e., they receive all sorts of information- relevant and irrelevant. The IT systems have to be configured to capture important information on a real time basis, to enable managers to make the right decisions, without wasting time.

Example: Supply Chain in Small-Scale Manufacturing Company in Nigeria

In Nigeria, small-scale manufacturing companies are heavily depended on effective supply chain, as government infrastructures, were poor or nonexistent. China or India was a major supplier of machinery and raw materials and the identified problems in supply chain were: language barrier, product quality, and support for after-sales services.

Deets Company was a sack producing factory located in Lagos Nigeria, manufacturing sacks for use in packaging of fertilizer, sugar, agricultural products. Deets' business sustainability had been under risk for the last five years. A survey and analysis ended up with two groups of suggestions for strategic changes. These were short-term and long-term.

Deets' business needed to bring in these changes for sustainability: Enhance brand and ensure dedicated distribution network, Produce quality products at reasonable prices and move away from general products, identify and develop capable distributors, Increase market share of PP bags category, Independent inspection companies to arrest loading and shipment of off-spec products, Procure machinery with strategic decisions towards, functionally, post-installation support and maintainability, Find funding source to sustain the raw materials order and pay suppliers in time, consolidate all orders to one supplier for better customer relationship and positing.

Source: https://www.scirp.org/journal/paperinformation.aspx?paperid=117729 July 2022, Accessed on 12/09/22

17.4 Use of Information in a Supply Chain

Information is the key component at every stage of decision making in the supply chain. At the strategic level, the information from other members in the supply chain is used, to undertake demand planning and design the supply chain network. At the operational level, such information forms the basis for decisions on the product range, capacity allocation and inventory levels. The management of the company has to evaluate how to make the best use of the available information.

The information is also used in decision-making relating to inventory, transportation, facility location, etc. as outlined below.

17.4.1 Inventory

Efficient inventory management requires timely and accurate information, regarding customer demand, supplier's lead time, production capacity, inventory carrying costs, etc.

17.4.2 Transportation

Transportation management involves decisions on transportation networks, routing and scheduling of shipments and shipment sizes. These decisions are usually based on information, relating to order size, transportation costs, customer locations, and warehouse locations.

17.4.3 Facilities

Facility-related decisions like new facility location, capacity allocation to a particular plant, etc. require information on various factors like customer demand, tariffs and tax incentives, facility costs, infrastructure, etc.

Example: Information Sharing on Supply Chain Performance

Research studies were made on the effect of information sharing, specific to a developing country, Nepal. The study could mine through the effects of the Supply Chain Performance (SCP) measures like cost, quality, delivery and flexibility by information sharing. The analysis was done on data collated from a survey administered to 131 supply chain participants. This set included growers, manufacturers, distributors/dealers, suppliers, wholesalers, retailers and logistics service providers. The summated finding that could be authenticated was that, information sharing had a vital key role in Supply Chains (SC) performance enhancement. It was curious to realize that performances of delivery, operations and flexibility had a strong impact on performance by strategic information sharing, while cost and quality did not get impacted or affected by information sharing.

Source: Performance – A Context of Developing Country, Research Gate, January 2022, https://www.researchgate.net/publication/361146045_Role_of_Information_Sharing_on_Supply_Chain_Performance_-_A_Context_of_Developing_Country January 2022, Accessed on 12/09/22

17.5 Changing Role of Information Technology in a Supply Chain

Information technology has evolved from mere transaction processing to its present role as an effective aid in decision making. IT applications have changed tremendously over the years with, advances in technology and changes in business needs. The development of information technology, in supply chain management, can be divided into four phases:

Phase 1

Information technology was first used for transaction processing applications, by automating several routine transactions. The applications are aimed to reduce costs and the need for human intervention. Payroll applications, accounting packages, and order entry systems are some of the products of information technology used in the first phase.

Phase 2

Later with advances in technology, applications that were capable of higher-level functions were developed. In this phase, IT was used to design systems that could handle complex functions like inventory management, order processing, job scheduling, etc. These applications are aimed not just at cutting costs but also at improving productivity and resource utilization.

Phase 3

During this phase, the hardware technologies and communication technologies improved at a faster pace; at the same time, prices fell considerably. In this phase, IT was used to develop applications, which could increase revenues and reduce costs. The different functions like inventory management, payroll, etc. were integrated through IT systems. An example of an integrated system is the ERP application, which collects information from all the functional departments so that the management has a better view of its operations.

Phase 4

During this phase, information systems have become more sophisticated and IT has been used by some firms, to enhance the effectiveness of their decision-making processes. In the supply chain, apart from being used for communicating with partners, IT has also been used to integrate and control various processes, across the supply chain.

17.5.1 Role of IT in Decision Making

IT is used extensively by supply chain members like suppliers, manufacturers, distributors, and retailers, to make strategic, tactical, and operational level decisions. There is a variety of IT systems that can gather and analyze data to meet the specific decision-making needs of a supply chain member. The role of IT systems, at each of the decision-making levels, is discussed below.

Strategic Planning level IT systems

Strategic level systems help the top management to decide on strategic issues in the supply chain like the location of facilities, allocation of work to each manufacturing plant, capital investment required, product lines to be manufactured, and demand forecasting. Decisions taken at the strategic level are based on broad information, drawn from several functional areas, and hence IT

systems designed for this level should have high analytical capabilities. Earlier, strategic decision-making depended on the experience and diligence of senior managers, but now, there are many IT applications and systems to assist the top management, in decision-making.

Tactical Planning level IT systems

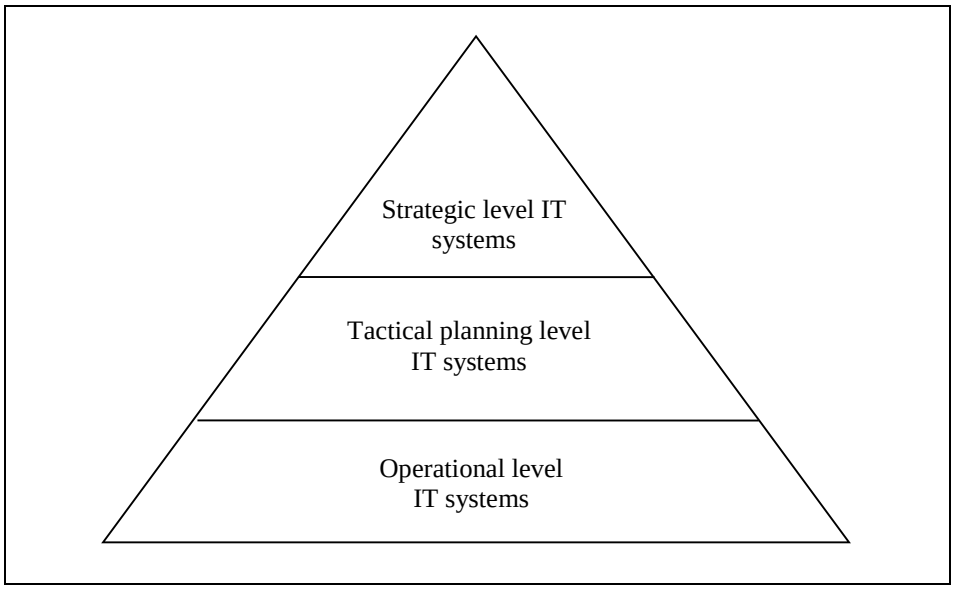
Tactical planning decisions focus on the optimal utilization of available resources in a profitable way that meets customer demand. The IT systems, at this level, are used mainly by middle-level managers. The systems help the managers in deciding the volume of production in a given time, and the level of production at each manufacturing plant. The systems also determine the level of inventory, which should be held at every distribution center. Like strategic level IT systems, tactical planning level information systems also require analytical capabilities, as they are used to make planning decisions, based on historic information like costs, capacities, and demand.

Operational level IT systems

Operational level IT systems are developed for lower-level managers who execute the instructions of managers at higher levels. These systems do not require analytical capabilities and are designed to record and execute transactions. These systems are used to make weekly and daily production schedules and are also used for tracking orders. The information gathered by these systems is fed into a database, which can be accessed by the tactical and strategic level information systems.

Figure 17.1 shows the hierarchy of information systems in an organization

Figure 17.1: Hierarchy of Information Systems



Source: ICFAI Research Centre

17.5.2 Service-Oriented Architecture (SOA)

Service-oriented architecture is a way of software design, in which services are provided to other users over a network, by application components through a communication protocol. Thus it involves the deployment of services, which are units of logic that run in a network. Service has the following characteristics:

- It handles a business process such as calculating an insurance quote or distributing email; handling a technical task such as accessing a database; or providing business data and technical details, to construct a graphical interface.
- It can access another service. With the appropriate runtime technology, it can access a traditional program and respond to different kinds of requesters, such as web applications.
- It is relatively independent of other software. Changes to a requester need a few or no changes to the service. Changes to the internal logic of the service require few or no changes to the requester. The relative independence, of the service and other software, is called loose coupling.

17.5.3 Radio Frequency Identification Technology (RFID)

RFID is an acronym for "radio-frequency identification" and refers to a technology, whereby digital data encoded in RFID tags or smart labels are captured by a reader via radio waves. RFID is similar to barcoding, in that data from a tag or label are captured by a device that stores the data in a database. RFID, however, has several advantages over systems that use barcode asset tracking software. The most notable is that RFID tag data can be read outside the line-of-sight, whereas barcodes must be aligned with an optical scanner. RFID application is very popular in retail stores like Walmart, which use this for warehouse management, inventory control, and other logistics in supply chain management.

Example: Smart Systems: Advanced Technologies at Amazon

Amazon was an online global e-commerce retailer. Their warehousing business model was based on their own cloud computing. It had 175 fulfilment centres with core objective of using data analytics for meeting demand consistently and assesses customer's demands. Smart Systems (SSs) applications facilitated a 'from start to finish 'fulfilment process in manufacturing and retail sector. Amazon's digital ecosystem was established to support in supply chain collaboration between Amazon and its partners for value chain inefficiency.

Contd….

Amazon used SSs, with IoT linked to cloud-based applications and its advanced algorithm to analyse its partners rather than integrating other systems into its own system. Amazon used its system in each process for inbound and outbound logistics, concentrating on improving timeliness and saving money with automation, machine learning, and artificial intelligence. Amazon focused on productivity through warehousing technology, efficiency and partnerships in digital ecosystem during their supply chain activities. SSs improved the speed of information flow, facilitating cost-efficient solutions in inventory and logistics management. SSs promoted internal and external information sharing and strengthened collaboration among partners.

Source: https://www.mdpi.com/2305-6703/2/3/20/pdf, June 2022, Assessed on 12/09/22

17.6 IT Solutions for SCM

With information technology advancing rapidly, many IT solutions have been developed for the effective supply chain management. Hardware solutions that are widely used in supply chain management are electronic data interchange (EDI) and other internet technologies. Application software solutions that are widely used in supply chain management are ERP and other SCM solutions. Let us discuss these solutions in detail in this section.

17.6.1 Electronic Data Interchange (EDI)

EDI is one of the earliest forms of IT, used for electronic commerce. It is aimed at the seamless exchange of information, among the members of a supply chain. EDI enables the electronic exchange of business documents between partners in a supply chain. Some types of documents that can be exchanged electronically are forecasts, quotations, inventory queries, purchase orders, sales orders, reclamations, order confirmation, delivery schedules, delivery notification, and invoices. These business documents are converted into standardized electronic message formats and communicated electronically to the partners, without paper documents being physically moved. Acquiring EDI capability has become a must for supply chain partners, in several industries.

The structure of EDI

EDI can be compared with email or sharing files within networks, in some ways. Email enables textual messages to be transmitted from one person to the other electronically, while EDI helps in delivering electronic documents, which have standardized data formats between two computer applications, not between people.

There are three essential elements of EDI:

Translator software: Translator software, which translates the data from the internal formats to the standardized format or vice-versa.

Standards: Standards define the formats, in which documents need to be created.

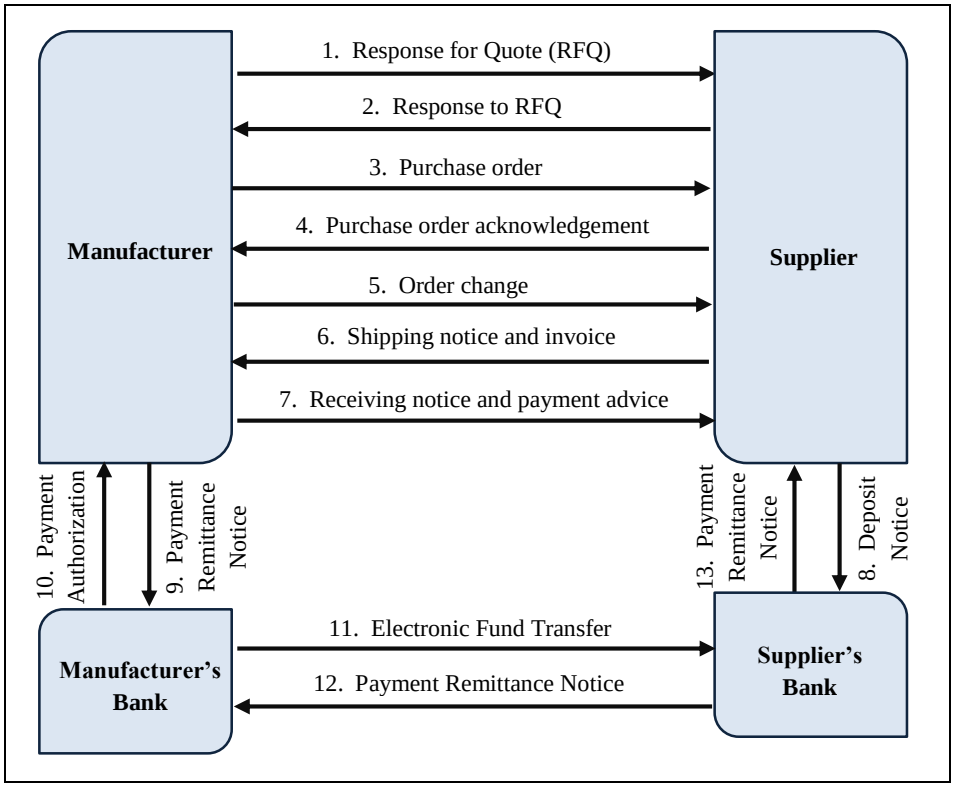
Communication medium: The communication infrastructure transmits the messages, from one trading partner to the other. Generally, the messages are transmitted through leased line connections, which link the trading partners directly or through third party network operators, known as value added networks (VANs). Now firms are looking at using the Internet as the communication medium because of cost and technology factors. Direct links like leased lines are desirable if the company has to deal with a few trading partners. But if the firm has to deal with a large number of trading partners, VAN services may be preferred because VANs provide a single channel, to communicate with multiple partners.

EDI involves five main processes:

- First, the buyer generates a purchase order and feeds the data into the system.
- The translator software converts the data into a transmittable format.
- The message is transmitted to the seller.
- The message is received and interpreted at the seller's end.
- Then the message is downloaded onto the seller's system.

Figure 17.2 depicts the EDI transactions between a manufacturer and a supplier.

Figure 17.2: Example of EDI Transactions between a Manufacturer and a Supplier



Source: ICFAI Research Center

Benefits of EDI

Reduction in transaction costs and time: The transaction costs, across the supply chain, are reduced due to savings in processing costs like labor costs, material costs, and communication costs. In normal cases, 70 percent of the computer output is re-entered in other computers, wasting resources and time. As the order details are entered only once in EDI, the productivity of the workers increases.

Administrative efficiency: The data is transmitted electronically and this eliminates postal and processing delays, manual re-entry of data, and transcription errors. Thus, administrative efficiency is increased, and employees can focus on other important strategic and operational processes.

Optimized inventory: As the information exchange is quicker and timelier, the firm, as well as customers, are able to determine optimal inventory levels. This results in a reduction in inventory and inventory carrying costs. EDI also helps in adopting the JIT system of replenishment.

Quality control: Customers rate the quality of the firm's products and services based on variables like consistency, timeliness, and cost-effectiveness. A high-quality customer service can be achieved through EDI. EDI helps in fulfilling orders quickly and to lower order processing costs. This results in improvement in customer service levels and the perception of quality by customers.

Improving trading relationships: With EDI, establishing links between the suppliers and customers becomes easier. This helps in building long-term relationships, with supply chain partners and customers. EDI also improves coordination and integration, in the supply chain.

17.6.2 Internet Technologies

Internet technologies have influenced supply chain operations greatly. The internet is a worldwide network of networks that uses TCP/IP protocol (the rules that provide basic Internet functions) for communication between one another. The internet's key advantages are open standards and low cost of building, maintaining, and implementing applications, based on the technology. These features enable the Internet to be used for automating supply chain operations and collaborating with partners. There are three key Internet-based technologies that are widely used in SCM. They are Intranet applications, extranet applications, and e-business applications. In this section, we deal with intranet and extranet applications. In the next chapter, we will examine how e-business is influencing the supply chain.

Intranet and extranet applications

Intranet can be defined as the private network of systems, within a company or organization. Intranet applications use Internet technologies to communicate with other nodes in the network but the access is restricted to a certain number of users, within the company. Intranet access is restricted by setting up firewalls and other

security measures, so that only authorized users can access the network. Intranets are mainly used to increase the level of coordination between departments, through quicker information sharing. Most of the Fortune 500 companies today have intranet setups. An *extranet* can be defined as a private network, where customers, suppliers, and the internal departments are linked. It can be termed as an extended intranet, where the intranet is extended to suppliers and customers.

Benefits of extranet

The key benefits of extranets are increased information sharing, decreased operating costs, improved business operations, and better customer service.

Increased information sharing: Information sharing is one of the key benefits of using an extranet. A secure network for information exchange, among suppliers, customers, and internal entities in the supply chain, enables speedy and accurate communication of critical data between them.

Decreased operating costs: Another major tangible benefit of using an extranet is cost reduction. Operational costs like communication costs and transaction costs can be reduced significantly. Many companies, transacting through EDI, now use an extranet for order processing activities like placing purchase orders, advanced shipment notices, processing payments, etc. This enables the company to make substantial savings.

Improved business operations: Linking the systems of suppliers with the company's systems improves the operations on the business front. For example, linking the point of sales of each retail outlet, with the supplier’s systems, can help in prompt replenishment of goods, thereby minimizing stock outs in retail outlets. This brings about efficient and responsive supply chain operations.

Better customer service: Better customer service is possible, when customers’ systems are linked with the firm's systems. Many logistics providers offer order-tracking status functionality to customers, through an extranet setup.

Activity 17.1
Information and information technology have greatly impacted, every aspect of operations management. • Identify the three most important advantages of information in supply chain management. • Briefly explain the way information is used for inventory management in a retail store.

Check Your Progress - 1

1. Which, of the following, is not a major advantage of information in supply chain management?
   a. Increase in efficiency of processes and effectiveness of operations
   b. Modernization
   c. Faster decision making
   d. Networking of all stakeholders
   e. Better customer care
2. Which, of the following, is the most important decision area supported by information, among all relevant decisions?
   a. Product range
   b. Customer communication
   c. Design decisions
   d. Capacity allocation
   e. Inventory management
3. Which, of the following, is not a targeted application for information, in supply chain management?
   a. Transaction processing
   b. Inventory management
   c. Order processing
   d. Cost reduction and profit enhancement
   e. Waste management
4. Which, of the following, is not a popular IT application, in supply chain management?
   a. Electronic Data Interchange (EDI)
   b. Supply Chain Management (SCM)
   c. Enterprise Resources Planning (ERP)
   d. Internet Technologies
   e. 3D-Printing
5. Which, of the following, is the most important advantage of IT, in supply chain management?
   a. Administrative efficiency
   b. Reduction in transaction cost and time
   c. Inventory Management
   d. Quality Management
   e. Relationships with stakeholders

17.6.3 Enterprise Resource Planning (ERP)

Before ERP applications were developed, the information in the supply chain resided in "information islands", in each department or company. Lack of information sharing among the supply chain members restricted the productivity of the supply chain. At the time, there was a lack of proper information flow and integration across the supply chain. ERP applications evolved over several decades. IBM developed a system of automating the materials planning function, known as Material Resources Planning (MRP). MRP consists of a set of methods that translates demand forecasts into product requirement plans for raw material, semi-finished products, and finished products. MRP is limited to controlling the flow of products and materials but does not help in total production control and coordination. This shortcoming was addressed by the improved version of MRP, called MRP II. In MRP II, the problem is structured hierarchically, based on the time scale and the level of product aggregation. Coordination in manufacturing flow is possible through the linking of various activities like demand planning, production planning, and scheduling, etc.

MRP II was still limited to the automation of manufacturing flow. The manufacturing function was not linked with other functions like marketing and finance. All these shortcomings were overcome in ERP.

ERP systems are operational IT systems, which enable information flow across all the functions in a firm. ERP facilitates information exchange across enterprises too. It gives the top management an enterprise-wide view of the information they require, in a timely, reliable and consistent manner.

ERP systems are basically transaction processing systems, so, they are used for monitoring transactions. ERP systems lack decision support tools, which can help the management to arrive at strategic decisions quickly. ERP systems have many more features and capabilities than MRP systems. As businesses, today, are adopting a process-oriented rather than a function-oriented approach, ERP systems, which enable cross-functional integration, are very appropriate for making the supply chain more efficient and responsive.

A typical ERP application has many functional modules, which are linked together so that a user of one function module can get data relating to another module. Some of the key modules that are offered by ERP application vendors are listed below.

Financials: This module helps the company in monitoring financial transactions such as cash management, receivables, payments, internal controls, etc.

Human resources: This module deals with enterprise-wide human resource activities like job scheduling, benefit administration, compensation management, performance management, etc.

Manufacturing: This module deals with the coordination of tasks associated with manufacturing like shop floor management, and requirements planning.

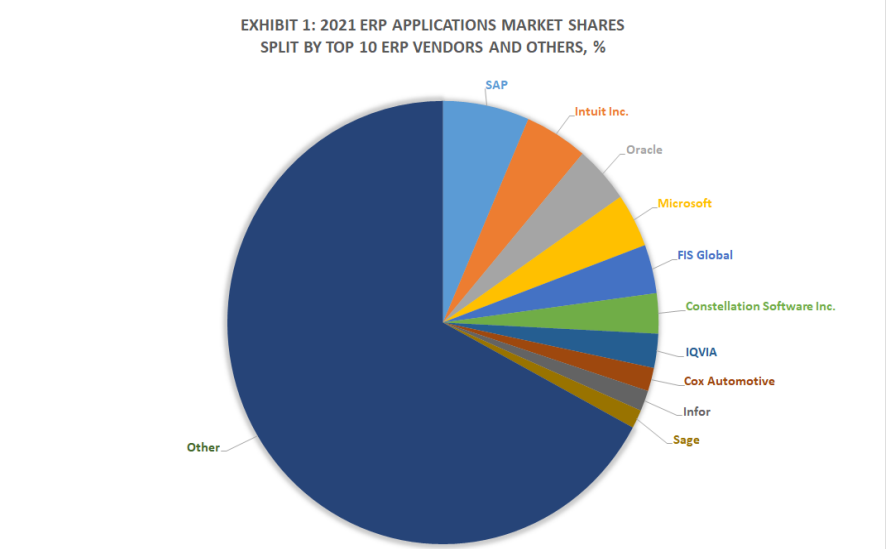
Order management: This module streamlines order processing and keeps track of the order, throughout the order management cycle.

Inventory management: This module provides inventory information across plants and warehouses, and even at the supplier's sites, on a real-time basis.

Purchase order management. This module enables efficient handling and execution of purchasing orders, through the quick processing of requisitions, quotations, request for quotations (RFQ's), receipts, etc.

There are also modules like travel management, real estate management, and incentive management, through which ERP can be used to monitor and control orders, people, costs and expenses, production, and supplies. Firms choose modules, based on their requirements. For example, a manufacturing company may choose the manufacturing and inventory management modules, while a retailer may choose a purchase order management module. Exhibit 17.2 provides an overview of the ERP applications of some top ERP vendors.

Exhibit 17.2: Overview of Top ERP Solution Providers



Source: https://www.appsruntheworld.com/top-10-erp-software-vendors-and-market-forecast/, September 26, 2022 (Accessed on December 15, 2022)

SAP

SAP is the market leader in the ERP systems installations worldwide. It serves more than 22,000 customers worldwide. It provides a range of modules, in its ERP applications. The key modules that are provided by the company are financials, human resources, and operations. The operations module includes purchase order management, inventory management, and production management. SAP has also added analytical modules like strategic enterprise management, and business analytics.

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Oracle

Oracle offers a complete range of modules including financials, human resources, manufacturing, purchasing, and sales. It is one of the early players to quickly refocus the applications towards the Internet. It is now selling these applications under "Oracle e-business suite".

PeopleSoft

PeopleSoft started as a human resource application provider. It has now expanded to other areas. The key modules that it offers are human resources, manufacturing, and financials.

Baan

Baan, now a part of the Invensys group, is another major player in the ERP market. Its product offering covers finance, sales, purchasing, logistics, manufacturing, and service functions.

Apart from these five major players, there are other players, who are catering mainly to medium and small size enterprises. They include great plains and navision, which have been taken over by Microsoft. In India, Ramco systems and ICICI Infotech are the key ERP solution providers.

Source: ICFAI Research Center

Another feature of ERP systems is the automation of processes. Automation reduces errors and helps in the efficient management of supply chain operations. But firms need to be aware that processes, which are poorly executed, will not give the desired results, even if automated. To get the most out of ERP implementation, the firm should analyze and improve the processes before they are automated.

ERP can increase the efficiency of the supply chain operations of any industry, as there are different versions of ERP for different industries. Each version has features, which are relevant to a particular industry.

Sometimes, a firm has to use the standard processes that are part of the ERP system it has installed. It may be possible to customize such processes in line with the requirements of the firm, but sometimes this is possible only up to a certain extent. Therefore, efficiency in the pre-ERP stage may be higher than in the post-ERP stage. However, visibility and the possibility of coordination are higher in the post-ERP stage. Therefore, firms, often, adapt their own processes, to meet the ERP system’s requirements, in the interest of greater visibility and usability of the information.

Benefits of ERP systems

If the ERP system is implemented properly, it can give the firm many benefits, such as:

Access to information: The key benefit of ERP is that the firm gets access to a wide range of information. More accurate and broad-based information enables the firm to make better decisions. For example, the marketing department can base its decisions, on information regarding the inventory at the warehouse. Since the information is available in real time, communication between departments or partners is speeded up and decision-making is also quicker.

Increased customer orientation: Previously customer orientation was restricted to the marketing and customer service departments. Other departments executed orders according to the directives of the top management. But with the linking of activities and processes with customer orders in the ERP system, all the departments became customer-centric, resulting in increased customer satisfaction and profitability.

Rapid new product development: Since all the departments are linked to the ERP systems, the costs and time required for new product development can be reduced. This is because all the members in the supply chain have access to the same information and any changes that are made by one member are communicated to all the participants. This improves coordination and helps in bringing in changes and new developments.

Disadvantages of ERP Systems

Lack of analytical capabilities: ERP provides information on the current status of production, raw material availability, etc., but it cannot predict the status of the same factors in the future. For example, ERP systems are capable of telling the manager what is the present level of inventory, but not, they can give how much inventory is required to satisfy the demand, given the constraints. However, ERP vendors are trying to increase the analytical capabilities, by developing additional analytical modules, which run on the existing systems.

High cost associated with the implementation of ERP applications: Installation of ERP systems is generally expensive. The costs incurred include those for consulting, process redesign, data conversion, training, integration, and testing.

Time: ERP installation takes some time to complete, because of the complex nature of ERP applications and the customization requirements. On an average, installation of an ERP package takes 12-18 months and tangible benefits may not materialize, until between one and three years, after implementation.

Training: Training is an important aspect of ERP installation. Since ERP is implemented across the company, the firm has to train all its employees to use ERP tools. This takes a long time, and without it, the benefits of ERP cannot be realized.

Acceptance: As ERP brings about changes in existing work processes, not all employees may accept the changes, resulting in delays in the implementation. The firm should take its employees and partners in the supply chain into confidence, when ERP implementation is being planned, to forestall later difficulties.

Example: IoT at SCM at Amazon

Technologies such as the Internet of Things (IoT), cloud computing, and Smart Systems (SSs) have become an important focus for industry, especially in the manufacturing and retail sectors. Amazon, global company's warehousing technology was based on Amazon's own advanced cloud technology. Their 175 fulfilment centres focussed on meeting current demand and predicting future customers' needs using data analysis.

Internet-based IoT business solutions influenced the quality and speed of information flow in the supply chain in the production environment. IoT could improve companies' productivity, and aided in reduction in costs. IoT helped in the shorter supply chain creation, and optimised networks. Amazon's digital ecosystem partnerships with Pentair and Siemens proved that IoT applications could ease complexity of supply chain and shorten procurement processes.

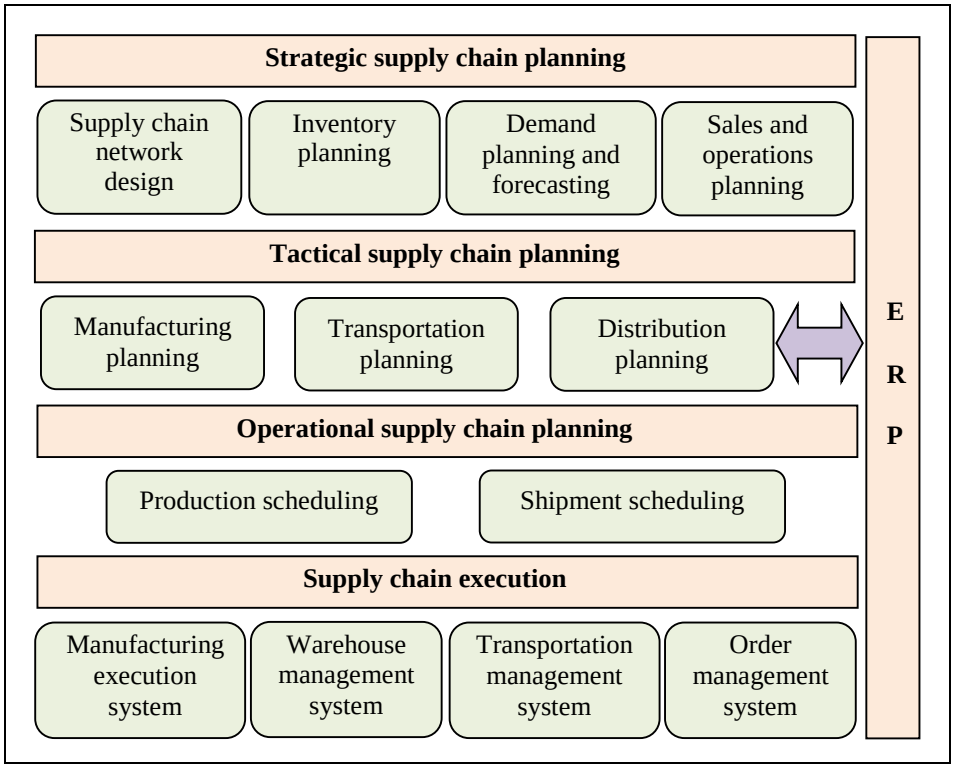
Source: https://www.mdpi.com/2305-6703/2/3/20/pdf, June 2022, Assessed on 12/09/22

17.7 Supply Chain Management Software

Supply chain management has five basic components, i.e., plan, source, make, deliver and return. Each of these components consists of numerous tasks, and plenty of software packages are available in the market, for each of these tasks. Many vendors have combined these task-specific software packages into a single module, to provide holistic supply chain solutions. Supply chain management software refers to the software, which automates the links among multiple points in a supply chain, and efficiently and effectively coordinates the flow of goods and information. Generally, an SCM software vendor offers a suite of applications, which have been developed in an integrated approach.

For our study of supply chain software, let us divide the available software into two categories: supply chain planning (SCP) software, and supply chain execution (SCE) software. SCP software deals with various planning processes in a supply chain such as demand planning and forecasting, supply chain network design, and manufacturing planning and scheduling. SCE software focuses on the operational part of the supply chain processes like transportation management, and warehousing management system. All supply chain management software packages can analyze the information supplied by the ERP system, to help the firm take optimal decisions. Analytical capabilities are incorporated into the software using sophisticated algorithms such as heuristics, mathematical programming, and genetic algorithms. Figure 17.3 gives a graphical representation of the components of SCM software.

Figure 17.3: Components of Supply Chain Management Software



Source: ICFAI Research Center

17.7.1 Supply Chain Planning (SCP)

SCP solutions, which were initially used to plan and schedule manufacturing operations, are now being extended to distribution and warehousing. Such SCP solutions are also called advanced planning and scheduling (APS) systems. Based on data from the transaction systems or ERP applications, supply chain planning solutions formulate forecasts and plans, to meet demand from customers. These solutions aim to develop feasible and optimal plans so that the firm can meet customer demand effectively and efficiently. A feasible plan is any plan that fulfils the customer demand, within the constraints facing the company. An optimal feasible plan is a plan that fulfils

customer demand, in the most cost-effective way and fulfils the customer orders, on time. High-end SCP solutions used in strategic planning make use of optimization techniques, which take into account all the constraints of the company, and arrive at a plan, with the lowest cost and most efficient utilization of resources, while also providing the highest value to the customer. The lower end SCP solutions just suggest various options for optimization, based on the demand. SCP solutions can be categorized at three levels: strategic, tactical, and operational.

17.7.1.1 Strategic Level Planning Applications

Strategic level planning applications enable the firm to develop strategic plans at the aggregate level such as the level of a geographic region. They could be used for forecasting regional demand, or for taking decisions on facilities to be set up in a particular geographical region. Complex algorithms and techniques are used to arrive at optimal plans. Some of the modules in this category are outlined below.

Supply chain network design

This module concentrates on utilizing resources optimally. It helps in identifying the optimal way, in which the customer demand can be fulfilled. Supply chain network design optimally allocates resources to various entities of the supply chain, i.e., the suppliers, manufacturing plants, warehouses, etc. It is used, for example, to determine the optimal allocation of production (according to the demand to be fulfilled), to each manufacturing plant and to determine, which distribution centers should serve which geographic regions. Supply chain network design is also used to identify suitable locations for setting up new facilities so that customer demand can be optimally met. The *'what if'* analysis feature, in this module, helps the management to study the impact of various permutations and combinations of the facilities and resource options on profitability and customer service levels. Long-term plans can be made using this module; facilities and resources do not change in the short-term or medium-term, so, it is generally used for planning for one year and above.

Demand planning and forecasting

This module is used for planning, how to influence demand effectively. Demand patterns can be influenced by promotions and external events. Demand planning determines the most effective ways of doing this. Demand forecasting helps determine future demand patterns, based on past sales history, by using statistical techniques. The demand planning and forecasting module makes plans, for periods between 6-18 months.

Sales and operations planning

This module is used to draw up sales and manufacturing plans, based on demand forecasts. Here, the manufacturing planning module and supply chain network design module may also be used to determine, whether demand forecasts can be met profitably. The time frame for sales and operations plans usually ranges between 6-18 months.

Inventory planning

In this module, the optimal finished goods inventory, to be held to meet the desired customer service levels, is determined. The level of safety stock required is also calculated. These plans are formulated, for periods ranging from 6-12 months.

17.7.1.2 Tactical Level Planning Applications

Tactical planning applications help the firm to determine the optimal utilization of the resources across the supply chain, within a given period. The focus in tactical planning applications is on narrower areas like demand forecasting for a particular product, and production plans at a particular plant. Tactical planning differs from strategic planning in that it is bounded by definite time constraints, whereas the strategic planning process is not. The time for tactical plans generally ranges from 1-6 months. Important modules under this category are outlined below.

Manufacturing planning

This module is used to draw up a master schedule, based on the material, capacity, labor, and other constraints of the firm. The plan is generally drawn up for a particular plant. The plan should indicate how the available production capacity in the plant could be used, to meet demand in a cost-effective manner.

Distribution planning

This functionality in the software determines the optimal transportation of goods, and also the stock levels of finished goods that need to be maintained, at each warehouse so that customer demand can be met satisfactorily. Given the demand forecast, it looks for the available storage capacity and location, and the available means of transportation. Then, it formulates a plan that can meet the customer demand in a cost-effective way through appropriate allocation of inventory and use of transportation options.

Transportation planning

The transportation planning module helps the firm, to determine the optimal outbound and inbound transportation of goods so that the existing transportation resources can be used to the fullest extent and at the lowest costs. The analysis determines the right shipment mode, carriers, and routes, based on the lowest cost of delivery, given the transportation constraints. The planning horizon ranges from 1 week to 3 months.

17.7.1.3 Operational Planning Applications

Operational planning applications are concerned with scheduling and rescheduling of the daily plans and weekly plans of the supply chain operations.

Production scheduling

Here, the optimal schedules of production for each plant are drawn up. The production schedules lay down the order lot-size to be produced and the sequencing of these orders, on the shop-floor. The orders are arranged according to the order due date and the available production capacity. Interruptions in the

manufacturing flow can also be taken into account and orders can be rescheduled appropriately. The time horizon for production schedules ranges from one shift to one month.

Shipment scheduling

Shipment scheduling involves determining the appropriate modes of shipment and the timing of shipments. The time horizon for shipment schedules ranges from one shift to one week.

All these functionalities or modules need to be integrated for greater planning efficiency in the supply chain. The output, from the SCP solutions, is used as an input for the supply chain execution (SCE) systems; the SCE systems convert the plans into specific instructions that are carried out, by the operating personnel. SCE systems are covered in detail in the next section.

17.7.2 Supply Chain Execution Systems

Supply chain execution systems focus on the operational issues in the supply chain processes. Examples of execution systems include manufacturing execution systems, warehouse management systems, and transportation management systems.

Manufacturing Execution Systems (MES)

Manufacturing execution systems integrate the material and work-in-progress flow, with the production process. These systems manage the allocation of production capacity, order priorities, work shifts and labor, dynamically. The MES takes inputs from the ERP and SCP systems and uses the information, to help manage operations on the shop-floor and make real time decisions.

Warehouse Management Systems (WMS)

Warehouse management systems deal with the day-to-day operations of warehouses and distribution centers. These systems help manage the inventory, order fulfillment, and material handling processes, in a distribution center. The information collected by the WMS is used to update the central database.

Transportation Management Systems (TMS)

Transportation management systems determine the optimal utilization of the transportation network to deliver goods to customers, at the lowest costs. The functions of the TMS include load planning, shipment scheduling, and labor management. These systems also determine the inbound and outbound modes of transportation and routes so that deliveries can be made in a cost-effective way, without adversely affecting the customer service levels in the supply chain.

Order Management Systems (OMS)

Order management systems help manage the order fulfilment process. These systems manage the order management cycle, starting from order capture to order

shipment. OMS sits between the planning and execution systems, as order management is the last step in the planning process and the first step in the execution process.

Exhibit 17.3 gives an overview of solutions that are provided by some of the top SCM vendors.

Exhibit 17.3: Overview of Various SCM Solution Vendors

i2 Technologies

i2 Technologies is the market leader in SCM solutions. At first, it focused on manufacturing planning and scheduling. Its initial flagship product was Factory Planner- a capacity planning application -which monitors and controls the orders and production capacity, on a daily basis. Later it expanded to demand planning and transportation planning applications. It is offering the solutions, under the umbrella of "i2 six" suite.

Manugistics

Manugistics is the second biggest player in SCM solutions. The company is strong in the manufacturing sector. The solutions that are a part of its SCM offerings are network design and optimization, manufacturing planning and scheduling, sales and operations planning, fulfilment management, collaborative VMI (Vendor Management Inventory) and CPFR (collaborative planning forecasting and replenishment), service and parts management, global logistics management, global logistics sourcing, and fleet management.

SAP

SAP, the market leader in ERP applications, is a relatively late entrant in the SCM solutions market. But by using its reach in the ERP segment, it has been gaining market share. SAP offers a complete suite of SCM applications, which include SCP and SCE solutions. The modules that are offered as a part of SCP suite are supply chain design, demand and supply planning, manufacturing planning, and transportation planning. The modules that are offered as a part of the SCE suite are materials management, manufacturing execution, order promising, transportation execution, and warehouse management.

Oracle

Like SAP, Oracle that focused on ERP solutions, is also a late entrant. With the growing importance of SCM solutions, Oracle offered SCM solutions, as an add-on module to the ERP package and also as a separate product. Modules that are offered by the firm are advanced supply chain planning, demand planning, collaborative planning, manufacturing scheduling, inventory optimization, global order promising, supply chain intelligence, product lifecycle management, procurement, manufacturing, and order fulfilment.

Contd….

Apart from these major players, there are other niche players who are providing individual or a limited range of solutions. Examples include Logility, Demantra, Red Prairie, Numetrix, and EXE Technologies.

Source: ICFAI Research Center

Example: Amazon Aurora usage for Inventory Database

Amazon delighted customers with selection of products from a large pool, faster and often free shipping. One should realize that, a simple, seamless shopping delivery needed a massive infrastructure and related activity specific technology. Amazon had four guiding principles: customer delight, highly passionate about invention, 100% dedication for operational excellence, and visionary thinking.

The Amazon Fulfillment Technologies (AFT) team managed the company's Warehouse Management Systems (WMS). WMS comprised of Inventory Management Services (IMS), facilitating all warehouse processes, inbound and outbound shipments, pick, sort and pack the item for shipping, and inventory storage, ensuring 100% on-time delivery all times. IMS used on-premises Oracle databases for their warehouses. AFT had the challenge of inadequate hardware provisioning.

AFT migrated the system to Amazon Aurora, MySQL, PostgreSQL, compatible databases for the cloud, at one-tenth of the current cost. They found that providing additional capacity was few mouse clicks away now. In addition, they also got the benefit of Aurora being fully managed by Amazon Relational Database Service (Amazon RDS), which automated administration tasks: hardware provisioning, database setup, patching, and backups. Another noticed advantage with Aurora was re-provisioning happened automatically in just minutes, protecting the data always and assured Amazon's business growth.

Source: https://aws.amazon.com/solutions/case-studies/amazon-fulfillment-aurora/, 2022, case study Accessed on 12/09/22

17.8 Process of Implementing an IT-Enabled SCM System

There are many steps in the implementation of an IT-enabled supply chain management system. As the implementation process is not just limited to one firm but involves all the firms spread across the supply chain, the process is usually complex and requires thorough analysis and planning. The implementation process is discussed below.

17.8.1 Evaluating Organizational Requirements

The firm has to first evaluate its organizational needs and its internal environment. It should analyze, whether supply chain management fits into the organization's

strategy and requirements. Implementing IT systems may require changes in the firm's relationships with suppliers and their internal business processes. So, the firm should analyze the implications of implementing the system. For example, implementing an e-procurement application may reduce the number of suppliers needed and marginalize smaller suppliers, who cannot afford to implement IT systems. Thus, implementing supply chain IT systems may have long-term implications for the partners in the supply chain. The firm should undertake a cost-benefit analysis and evaluate the threats and opportunities, involved in implementing the IT systems.

Once the firm has examined all considerations and has decided to implement an IT system, it is usually the firm's IT department, which oversees the implementation. There is a need for the IT department to interact with users and functional area heads, to help it decide upon the course of action. The types of systems that can be implemented can be explored. The acceptance and level of readiness of the staff are also determined, at this stage.

17.8.2 Evaluating the External Environment

Next, the firm has to evaluate the external players i.e., upstream members like suppliers and downstream members like customers. For this, the firm should choose a few supply chain partners, to implement a pilot project. It should select partners, who are willing to build a long-term relationship with the firm, as this is crucial for successful implementation. The firm should also assess the partners' readiness, to participate in the implementation. The partners' awareness and expertise in technology are other factors to be considered. The chosen partners should have technical resources that are compatible, with the firm's resources. Once the pilot project partners are selected, the next step is to decide on the technology to be used, i.e. the hardware and software solutions.

17.8.3 Identification of IT Infrastructure

The selection of IT infrastructure is the key to the smooth functioning of the IT system. The selection should be based on the requirements of the firm and also of the supply chain partners. The selection parameters should also include the reliability, quality, and functionality of the hardware and software.

17.8.4 Actual Implementation of the IT System

The IT system may be either developed in-house or outsourced. It is also possible to buy an off-the-shelf package, many of which are available in the market. As the scope of the system extends beyond the firm to outside partners, the implementation is often complex and time-consuming. The success of implementation depends, not just on the ability and expertise of the firm, but also on the partners' level of readiness and cooperation. If some partners have already adopted certain systems in their firms, the compatibility of the systems could become a key issue, in implementation. This problem is greater if the partners or

the firm use proprietary systems. Thus, it is better for a firm to adopt a system based on open standards, which enables easier integration with different systems. Another important issue in implementation is to convince the partners, to adopt the system. The firm may use different strategies for this. If the firm is a major member of the supply chain, then partner firms will usually defer their plans. Big firms like Walmart, Ford, and GM are examples of this situation. Otherwise, the firm can provide incentives and concessions, encourage its partners to adopt the system. It may provide discounts or assistance to its partners, through training and implementation support.

17.8.5 Scaling Up the System

If the pilot project is successful, the firm can extend or expand the system to other supply chain partners or to other functions. If the firm has implemented the application with one or two partners, then the application can be extended to multiple partners. The firm can also try to add other services or systems, depending upon the success of implementation of a particular system. For example, if the firm has implemented an e-procurement application, the firm can move on by adding other functionalities to the application like electronic payments so that the entire purchasing function is automated.

17.8.6 Implementation Issues

There are several implementation issues that need to be resolved. The first issue is, whether the implementation should be module-by-module or system-wide implementation. In a module-by-module implementation, the company implements certain modules before others. This type of implementation keeps implementation costs down. The process of change is also more gradual and the implementation is smoother. The other approach to implementation is system-wide implementation. System-wide implementation takes much more time. Companies adopt module-by-module implementation, as it is faster and enables them to catch up, with their competitors. Module-by-module implementation is usually recommended. But the firm should ensure that the focus is on system-wide integration and the implementation of each module should be undertaken, with this in mind.

The next issue is, whether to select a single integrated suite or to pick “the best of the breed” system for each module. Choosing a single integrated suite can reduce costs and integration problems, between different modules. However, the downside of such selection is that all the modules may not be the best of their kind.

The best of the breed approach involves choosing the best application for each function and integrating them later. The upside of this approach is that the best solution is used, for each function. But on the downside are the problems, relating to integrating different applications, which may be based on different standards and platforms. The cost of separate solutions is also higher than that of integrated

suites. Firms should evaluate the options carefully and decide on an approach that suits the company's requirements.

Another issue, which the firm has to consider, is the scalability and ability of the application to meet the firm's future needs. Since organizational requirements and market conditions are dynamic, managers need to analyze and select solutions that can cater to the future needs of the firm. In other words, the solution needs to be flexible and compatible with other standards and technologies.

Another issue in IT implementation is the after-sales support, provided by the solution provider. Since IT applications are used over long periods, after-sales support is essential for the smooth functioning of the system. The firm should choose a solution provider, who has a good standing in the market and will provide the necessary support.

Example: Making a healthier supply chain.

Merck Serono International S.A. was the division at Geneva of the parent company Merck KGaA of Darmstadt, Germany, which was a global pharma and biotechnology leader famed for bringing therapeutic innovations.

Their major research areas were: oncology, neuron-degenerative diseases, fertility, endocrinology and cardio-metabolic care, and autoimmune and inflammatory diseases. Merck Serono's had the biggest challenge of integrating two very different supply chains including traditional as well as biotechnology-based pharmaceuticals.

Merck Serono chose supply chain driven by Blue Yonder's Luminate™ Planning and Luminate™ Logistics capabilities which centrally created and managed their supply chain. With New forecasting capabilities, Merck Serono had an enterprise-wide approach and sharing of forecasting methods. Thus, Merck Serono could gain many advantages: improved response to shifts in demand, achieving high customer-satisfaction levels, reducing inventory costs, making available inventory across their places, and maximize sales. This resulted in accurate response to fluctuating demand. Blue Yonder's solutions enabled Merck Serono address what-if scenarios and inform changes across the complete supply chain organization. Merck could achieve process compliance for all their operations, seamless integration in complete life cycle of operations, enhanced efficiencies and increased shareholder value. The complete automation of the data transfer from the various systems built confidence in manufacturing users about missing of no details, need to check data or depend on other supply chain stakeholders for information.

Sources: i) https://www3.technologyevaluation.com/publications/t/case-study?pagenum=2

ii) https://www3.technologyevaluation.com/research/case-study/blue-yonder-is-the-remedy-for-a-healthier-supply-chain.html Blue Yonder February 21, 2022 Accessed on 12/09/22

Activity 17.2

The impact of information technology on operational efficiency is immense. This is further intensified with the development of a number of tools and techniques.

Identify one important tool and explain how it can address the requirements of various stages in a supply chain to facilitate operational excellence.

Check Your Progress - 2

6. Materials Resource Planning (MRP) systems were the forerunners of ERP (enterprise resources planning) Systems. Which of the following is a major limitation of MRP?
   a. Inability to link manufacturing flow with other functional areas.
   b. Controlling the flow of products and materials.
   c. Total production control and coordination.
   d. Demand planning, production planning, and scheduling.
   e. Inventory management
7. Which of the following is a real advantage of ERP in supply chain management?
   a. Cost reduction of processes
   b. Cross-functional integration
   c. Efficient inventory management
   d. Cycle time reduction in product delivery
   e. Increase in profitability
8. Which is the most important reason discouraging many organizations from implementing ERP?
   a. Skill development
   b. Convincing the employees to accept
   c. Cost of Implementation
   d. Obsolescence of technology
   e. Many failed implementations

9. Which of the following is not a core issue in ERP?
    a. Software
    b. Process Flow
    c. Customer Mind-set
    d. Change Management
    e. Employee cooperation
10. Which is the best way of implementing ERP systems?
    a. Project management approach
    b. Total outsourcing approach
    c. Public-private partnership
    d. Venture capital support
    e. Total investment by the shareholders

17.9 Summary

- Information flow is an important flow in the supply chain. Without the seamless flow of information, the supply chain cannot operate effectively.
- Information flow enables coordination between the members of the supply chain. Through the use of information systems, trading partners get access to and exchange information. IT systems also support the decision-making processes of a firm.
- Discussed the importance and use of information, in the supply chain and also how information technology makes the supply chain more efficient and responsive.
- IT systems have evolved from mere transaction processing systems to decision support systems, which exist at present.
- Discussed the IT options available, for supply chain operations. These are EDI, Internet technologies, ERP applications, and supply chain management software.
- EDI enables electronic exchange of key business documents, between trading partners.
- Internet technologies include intranet, extranet, and e-business applications. Intranet is any private network set up within an organization. Extranet is any private network, where customers, suppliers and the internal departments are linked.
- Discussed ERP applications and their features. ERP is a transaction processing system, which enhances information visibility across the firm.

- Finally, discussed SCM software. SCM software can be divided into two components: supply chain planning software and supply chain execution software. Finally, we looked at, how an IT-enabled supply chain management system can be implemented.

17.10 Glossary

ERP: Enterprise Resource Planning. ERP is an IT-enabled transaction processing system, which enhances information visibility across the firm.

MES: Manufacturing Execution System. Manufacturing execution systems integrate the material and work-in-progress flow, with the production process.

MRP: Materials Resource Planning. MRP is an automated material planning system, which consists of a set of methods that translate demand forecasts into product requirement plans for raw material, semi-finished products, and finished products.

OMS: Order Management System. OMS helps to manage the order fulfilment process.

TMS: Transport Management System. TMS determines the optimal utilization of the transportation network, to deliver goods to customers, at the lowest costs.

WMS: Warehouse Management System. WMS deals with the day-to-day operations of warehouses and distribution centers.

17.11 Self-Assessment Test

1. Establish the value of information flow in a supply chain.
2. What is the use of information in a supply chain?
3. Trace the changing role of information technology in a supply chain.
4. Which are the IT solutions for SCM?
5. Mention a few available and popular supply chain management software.
6. What are the core concepts of ERP? What are the main advantages and disadvantages of ERP systems?

17.12 Suggested Reading / Reference Material

1. Ashley McDonough, Operations and Supply Chain Management Essentials You Always Wanted to Know: 15 (Self Learning Management Series) Paperback – 1 January 2020.
2. Russel and Taylor, Operations and Supply Chain Management, 10 ed, ISV Paperback – October 2019.
3. Chopra and Kalra, Supply Chain Management 6/e Paperback – 17 June 2016.

17.13 Answers to Check Your Progress Questions

1. (b) Modernization

It is not a major advantage of information in supply chain management.

2. (b) Customer Communication

It is the most important decision area supported by information.

3. (e) Waste management

It is not a targeted application of information in supply chain management**.**

4. (e) 3-D Printing

3D printing is not a popular IT application in supply chain management**.**

5. (b) Reduction in Transaction costs and time

It is the most important advantage of IT in supply chain management.

6. (a) Inability to link manufacturing flow with other functional areas

This is the major limitation of Material Resources Planning.

7. (b) Cross-functional integration

It is the most important advantage of ERP in supply chain management.

8. (c) Cost of Implementation

It is the most important reason discouraging organizations to implement ERP.

9. (e) Employee cooperation

It is not a core issue in ERP.

10. (a) Project Management approach

It is the best way to implement ERP.

Unit 18

E-Business and the Supply Chain

Structures

"The nemesis of supply chain is bad communication."

- EverythingSupplyChain.com.

18.1 Introduction

E-business has Internet as the base platform to connect, communicate, build relations, share, promote and do more business with prospects. Supply chain is another back bone for manufacturing or services organizations, connecting all the intermediaries to deliver right product, on time at right place at right cost. Thus, e-business and supply chain complement each other in excelling at customer satisfaction and business growth.

In the previous unit, we discussed the value of information and the use of information technology in the supply chain. The concepts covered include the value of information flow in the supply chain; the use and evolution of information technology in the supply chain; various IT solutions that are used to manage the supply chain; and the process of implementing an IT-enabled supply chain management system.

Nowadays, the power of the Internet is being used, to deliver the right products and services to the customers in the shortest possible time. "E-business", as defined by David Simchi-Levi and Edith Simchi-Levi, "is a collection of business models and processes, motivated by Internet technology, and focusing on

improvement of extended enterprise performance." E-business can help the firms to visualize information, across the supply chain and respond to changes in a range of variables like customer demand, or shortages at the levels of customers and suppliers, etc. E-business has enabled firms to implement supply chain concepts more effectively than before. The supply chain concepts consist of information sharing, cross-enterprise collaboration, mass customization, outsourcing, partnerships and strategic alliances. When used properly, e-business can decrease logistics and manufacturing costs, reduce lead times, and make the firm more flexible and responsive to customer demand. The success of two companies- Dell and Amazon.com, gives a better picture of the power of e-business. Both these companies have used e-business, to change the way they interacted with the end customer and other supply chain partners.

This unit concentrates on the impact of e-business on a supply chain and various e-business applications that can be used, to enhance the efficiency and effectiveness of a supply chain. First, we discuss the impact of the Internet on the supply chain. Next, we examine the impact of e-business on the supply chain, from revenue and cost perspectives. Later, we look at various forms of e-business applications that are widely used in supply chain operations. Finally, we examine the way the e-business proposition is implemented.

18.2 Objectives

By the end of the unit, you will be able to:

- Explain the impact of internet and e-business on supply chain
- Identify the types of e-business applications
- Discuss implementation of the e-business proposition

18.3 Impact of the Internet on a Supply Chain

The Internet links various entities of the supply chain electronically. Electronic linking through electronic data interchange (EDI) has existed before the internet. But the Internet has many advantages compared to other technologies they are:

- The Internet is in the public domain, so participants can access the network at a low cost. The cost is low because participants do not have to pay for participating in the network, unlike EDI. So, the low cost and easy accessibility of the Internet increases the participation of supply chain members.
- The Internet is based on common standards of TCP/IP, which reduces integration costs. Standardization is important in supply chains because it enables faster adoption of supply chain practices.
- The Internet enables real-time communication. This results in increased flexibility and responsiveness in the supply chain.

- The Internet supports various data structures, facilitating collaboration among the supply chain members. Since different members of the supply chain follow different standards, collaboration becomes difficult. As the Internet supports multiple data structures, collaboration among the members of the supply chain can be easier.
- The Internet is an open architecture, which enables many-to-many configuration. Thus, it has a wider reach and can achieve more value and economies of scale.

Internet-based applications enable greater outsourcing, improve collaboration, increase differentiation and compress or shorten the supply chain.

Due to the cheaper communication costs of the internet, the outsourcing of supply chain operations is on the rise. Such outsourcing started with routine and simple tasks like transportation and warehousing and later moved to higher-level activities like order processing, and manufacturing activities. Even the strategic level operations, like complete order fulfilment, have witnessed outsourcing. With each increasing level of outsourcing activities, there is an increase in the extent and frequency of communication between the members of the supply chain. Thus, for strategic level outsourcing activities, real-time information sharing is required. The Internet is an ideal and efficient mode of communication through which real-time information flow is possible. The members of a supply chain can share key information like demand forecasts, store-level sales, inventory levels, etc., which facilitates collaboration between the members. With the use of the internet, restructuring and reassigning of tasks in the supply chain is possible, making way for new collaborative initiatives like vendor managed inventory (VMI).

The internet enables firms to design different supply chains to meet specific needs, instead of using the same supply chain design, for satisfying the needs of different customer segments. Examples of such differentiated supply chains are drop shipping, click and mortar models, pull-based supply chains, and a hybrid form of push-pull based supply chains.

The internet also compresses or shortens the supply chain. A prominent example of this is Dell. By adopting an online business model, Dell is able to eliminate intermediaries in the supply chain, thus shortening it.

Example: IOT in Supply chains at DHL Logistics

DHL was a German courier, which delivered packages and express mail company (a division of the German logistics Deutsche Pos). Their entire business activities were dependent on intelligent supply chain operations. Internet of Things (IoT) was a proven valuable tool for them. While scanners and sensors were definite part of this activity, there was more to appreciate from the experiences of DHL.

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The advances in cloud data storage, artificial intelligence, and cellular networks augmented the implementation and 5G technology and increased cellular connectivity, bringing global networks of connected devices. This brought real time automated communication and collaboration between countless "things" across global supply chains.

IoT delivered the required resilience for logistics operations. IoT devices were getting affordable with reference to device lifetime, functionality, and price. IoT technologies were providing global connectivity with Low-Power Global Area Networks (LPGANs), Low-Earth Orbiting Satellites (LEOS), and connecting hitherto uncovered remote areas. IoT had changed manual monitoring environmental conditions of the warehouses; trans-shipment packages etc. to automation and real time data sharing to central controlling areas.

Many pharmaceutical products needed temperature-controlled environments during inspection or loading and unloading as well transportation. IoT devices recorded and reported deviations from the prescribed parameters to the required stakeholders (Cold chain monitoring). Another crucial area where IoT was proving beneficial was security and loss prevention in logistics and supply chain. IoT helped track and monitor the goods movement around warehouses, distribution centers and all through the entire supply chain. IoT devices could be in multiple shapes and sizes to detect temperature, humidity, light, vibrations, etc., and because of the size, could support the investigation during loss and in locating the missing goods.

Source: https://www.dhl.com/global-en/delivered/digitalization/the-value-of-iot-in-supply-chains.html, May 2022, Accessed on 15/09/22

18.4 Impact of E-Business on the supply chain

E-business, which started influencing the retail business, extended to the entire supply chain. It started benefiting the manufacturers, supplier and service providers in many ways, some of which are briefed below.

18.4.1 Revenue Impact of E-Business

E-business provides many opportunities to maximize the revenues of the firm. Some of these opportunities are discussed below:

Provides a direct marketing channel

Through e-business, firms can open virtual storefronts that are directly accessible to customers. The firms can sell their products, directly to the customers. By doing business through an online storefront, the firm can also eliminate all or some of the supply chain intermediaries. But for firms, who sell products through their intermediaries, moving to an e-business model can be difficult. This is

because the virtual storefront can be a competitor to the firm's intermediaries, which may be unacceptable to the intermediaries. Such situations are usually faced by furniture manufacturers and automobile manufacturers, a major portion of whose business comes from dealers. By moving the business to an online channel, conflict may arise between the online sales channel and dealers.

Provides round the clock access to the customers from any location

Unlike a physical store, in e-business, customers can order the products, at any time. Such an option helps the customers, especially working executives, who are unable to shop at regular shopping hours.

In a traditional retail setup, the reach of the stores is restricted to a particular area. But through e-business, a company can reach out to a wider segment of customers across the globe. For example, before entering the Canadian market, Amazon used to get substantial business from Canada, despite lacking a physical presence in the market. This may not be possible in the traditional retail business set up.

Aggregating information and services from various sources

Using e-business, a firm can provide information and services, aggregated from various sources to the customers. Detailed information about the complete range of products of the firm can be put on the website. It is not possible to replicate this in a physical set up, as the firm may not be able to stock its entire product range, in a retail outlet.

Another way to aggregate information and services is to link the company's website, with the websites of its outside partners. Firms can tie-up with partners, who can provide complementary products and services, to provide a wider choice of products and services to the customers, at a single place. For example, apart from its own store channels, amazon offers the storefront of leading retailers like Target, GAP, ToysR' Us, borders, and circuit-city on its site. This opens up revenue opportunities and provides a wider choice and variety to customers. Such an arrangement also helps participating retailers to enhance their reach and revenues. Only a wide range of goods that offers ample choice would attract customers. A user-friendly site, which provides easy navigation for finding the product is another prerequisite for attracting customers. For example, staples, a leading office products supplier offered a wide range of products on its website, but could not attract customers as expected, due to poor site design and navigation. After revamping its site, it was able to attract a larger number of customers.

Personalization and customization features

E-business enables the firm to offer personalized product and service offerings, by using the information on customer preferences and buying behavior. For

example, a firm using appropriate technology and tools can identify customers' locations and offer products and services specific to that region.

Mass customization is another important advantage of the Internet. Mass customization refers to offering customized products to each customer, in a cost-effective way. For example, Dell offers its customers an option to customize the computers they purchase, according to their needs. Personalization and customization can strengthen customer relationships and thus increase revenues.

Faster time to market

With e-business, firms can launch new products faster than with traditional distribution channels. When introducing a new product in the physical environment, a firm has to manufacture and send the required quantity of the product, to each of its retail outlets. However, in the case of an online channel, the firm can launch a new product, just by adding the product to its product list on its website, without having to distribute it physically to many locations. For example, Amazon offered the latest book in the Harry Potter series to its customers, much before its official launch in book stores. It began delivering the orders as soon as it received the stock from scholastic, the publisher of the book.

Implementing dynamic pricing

With e-business, a firm can change its prices quickly and simply, just by changing the price information in its website's product database. This allows the firm to fix prices, based on demand and supply. Changing prices on a website can be faster and easier than changing prices through traditional channels. For example, if Hewlett Packard wants to change the prices of its personal computers, it has to go through the process of informing all its downstream supply chain members, salespeople, and its customers. In contrast, for Dell, an entry on the website will suffice.

Allowing price and service discrimination

E-business enables the firm to differentiate prices and service, on the requirements of the customer. A firm can thus provide different services or different levels of the same service, to different customers, and charge them differently. This is a common practice in the airlines and personal computer industries.

Even with all these advantages, e-business suffers from one serious drawback, in comparison to traditional supply chains. In a traditional retail outlet, the product can be delivered immediately to the customer; this is not possible in e-business, except in the case of digital products such as software and music, which can be downloaded. It takes a longer time to deliver the product in e-business than in most traditional businesses. So, for customers, who want the goods to be delivered at short notice, the internet is not the right channel.

18.4.2 Cost Impact of E-Business

Apart from providing opportunities for maximizing revenues in the supply chain, e-business applications also provide opportunities for reducing costs. Some of the positive effects of e-business on costs in a supply chain are described below:

Reduced product handling with a shorter supply chain

Manufacturers like Dell computers have adopted a direct business model that eliminates intermediaries, resulting in a shorter supply chain. This may also reduce handling costs, due to fewer supply chain stages, resulting in substantial reductions in overall costs.

Postponing product differentiation till the order is placed

E-business enables firms to reduce inventories by postponing production until after the customer order is placed. For example, Cisco assembles its routers only after the customer places an order. Instead of finished products, it can keep its inventory in the form of components. This results in a reduction in inventory holding costs.

Enabling the movement of digital goods

E-business speeds up the distribution and delivery of digital products. Customers can download music files, new software products, software upgrades, e-books, and even movies, over the Internet. Since the cost of delivering these products over the Internet is negligible, firms can gain substantial savings. This also reduces packing and order preparation costs.

Reduction of facility and processing costs

E-business can help firms to reduce facility and processing costs. Inventory can be held at a few large warehouses, instead of many small field warehouses. For example, an online bookseller needs to maintain the stock in only a few warehouses, whereas a traditional book store chain would need to maintain inventories at each of its stores. Thus e-business reduces the number of facilities to be operated, within a supply chain.

E-business also enables firms to save on resource costs. Since the website provides detailed information about the products including their availability and delivery status, firms can minimize the number of customer service centers and associated personnel.

E-business enables firms to save on order fulfilment costs, by making use of the time gap between the placing the order and its delivery. In a physical store, the goods have to be delivered to the customer immediately, which is not the case with a virtual storefront. Websites also do not need sales personnel and cashiers to process the orders, thus providing savings on personnel costs. By keeping adequate buffer stock, and utilizing the time gap between order placement and order delivery, firms can manage the order fulfilment process smoothly.

Reducing inventory costs through aggregation

E-business enables firms to reduce inventory-carrying costs, through the aggregation of inventory. By aggregating inventory at a few warehouses, firms can hold lower levels of inventory. For example, an online grocery store maintains inventory, only at its warehouses; a physical grocery chain-store maintains the inventory, at its warehouses and its retail outlets, resulting in higher inventory levels as well as higher inventory carrying costs.

Improves information flow

E-business makes the information flow across the supply chain easier and faster. Using e-business applications, firms can share key information like demand forecasts, with all the participants of the supply chain. This results in better coordination, among the participants of the supply chain. With faster, timely, and more accurate information flows, the mismatches between supply and demand tend to decrease. Thus, e-business also helps firms to decrease the influence of the bullwhip effect.

18.4.3 Cost Disadvantage of E-Business

There are also some cost disadvantages associated with e-business enabled supply chains, in comparison with the traditional ones. Let us examine some of these disadvantages:

Increase in outbound transportation costs

Inbound transportation costs per unit are lower than outbound transportation costs, for firms using e-business applications in their supply chains because replenishment orders are usually much larger than customer orders. The overall transportation costs are also higher for firms, with e-business enabled supply chains. In a physical store set up, the inventory is distributed over many field warehouses and retail outlets, which results in higher transportation costs for inventory replenishment. As a result, the inbound transportation costs per unit, for such an organization, are higher than in an e-business set up, where inventory is aggregated at a few warehouses. But as these few warehouses must service customers dispersed over much larger geographical areas, outbound transportation costs per unit are higher in firms, with supply chains using e-business applications.

Increase in handling costs

Handling costs may rise due to decreased participation of customers in the order fulfilment process, in an e-business setup. In a physical retail outlet, customers pick the products they want, from the store shelves. In an e-business set up like that of Amazon, the firm itself has to perform the order picking and order delivery activities, which are usually performed by customers in the physical set up the retail environment. This increases the handling and transportation costs for firms adopting an e-business model.

Example: The Influence of E-Commerce Services on Supply Chain in Indonesia

Indonesia MSME supply chain analysis results demonstrated that there existed a positive correlation of e-commerce service variables on the supply chain performance of the MSME. Fully functional e-commerce could help SMEs in reduction of costs, maintain optimal inventory management, and increase the operational efficiency and market expansion by facilitating excellent customer service. E-commerce had a definite, positive and measurable impact on the marketing performance of MSMEs, and IoT technology helped in reduced risk. It was expected to significantly lower market risk related to supply chain finances, development success, improved communication, leading to better economic development. The e-payment services usage had proven to be a statistically significant positive influence on the performance of Indonesian MSMEs.

Source: https://www.mdpi.com/2199-8531/8/3/119/pdf?version=1657633952 May 2022, Accessed on 15/09/22

18.5 Types of E-Business Applications

E-business applications can be categorized into three types: (i) E-commerce, (ii) E-procurement, and (iii) E-collaboration. E-commerce is concerned with the order fulfilment process; these applications help in coordinating activities among the trading partners, to meet customer demand. E-procurement enables the purchasing of components and raw materials, over the Internet. E-collaboration enables firms to share information among the supply chain members.

Let us examine each of these applications and their impact on supply chain performance.

18.5.1 E-Commerce

E-commerce can be defined as the performance of commercial transactions electronically. With the placement of the customer order, a series of transactions take place in the supply chain. These transactions have to be expedited if the orders are to be processed and delivered to the customers on time. For this, coordination among the supply chain partners is necessary. As the order process travels across the supply chain, tracking the order is another function, which needs to be taken care of. After-sales service activity should also be tracked and monitored. These are the functions performed by E-commerce applications. In other words, E-commerce applications manage all the order processing activities for an online store. Following are some of the functions that are performed by E-commerce applications:

- Process customer orders
- Enable supply chain members to communicate

- Provide real-time order tracking functionality
- Provide remote sensing and testing services
- Report and analyze the performance of supply chain activities

At the online storefronts of Amazon and Dell, the E-commerce applications manage all order processing activities. These applications provide relevant information regarding the products, their availability, delivery status, and payment processing.

These applications also ease communication, among the members of the supply chain.

Activity 18.1
The Internet has changed the face and approach to supply chain management, whether it is manufacturing or services. Identify the significant changes and the advantages provided by the Internet in the domain of supply chain management.

Check Your Progress - 1

1. What is the main focus of e-business application?
    a. Improvement of extended enterprise performance
    b. Minimization of logistics problems
    c. Reduction of manpower
    d. Reduced manufacturing and increased services
    e. Work from home
2. Which, of the following statements, best describes e-business?
    a. It is a paperless business strategy
    b. It is internet procurement
    c. It is networking with stakeholders/partners
    d. It is a strategy to reduce overheads
    e. It is a collection of business models supported by internet technology

3. Which, of the following, is the best feature of the internet in supply chain management?
   a. It is in the public domain and low cost
   b. Networking with participants is easy
   c. No additional charges for the network
   d. Works on common standards and makes integration simpler.
   e. Enables many to many real-time communication
4. Which, of the following, is the best advantage of the internet in supply chain Management?
   a. Enables greater outsourcing
   b. Improves collaboration
   c. Increases differentiation
   d. Compresses the supply chain
   e. Removes intermediaries
5. Which is the main advantage of e-business?
   a. Saves on travel costs
   b. Saves on negotiation burden
   c. Saves on quality control
   d. Enables the visualization of information across the supply chain
   e. Increases profitability of supply chain operations

18.5.2 E-Procurement

E-Procurement deals with automating all the purchasing functions, from purchase requisition to payment transaction. E-Procurement applications help firms, by increasing the efficiency and improving the effectiveness of the supply chain. They increase efficiency by lowering procurement costs, decreasing lead time, reducing unauthorized buying, organizing information, and integrating the back-office systems with the procurement function. E-Procurement improves efficiency by enabling better control over the procurement function, by making procurement information more visible, and by helping in making better purchasing decisions.

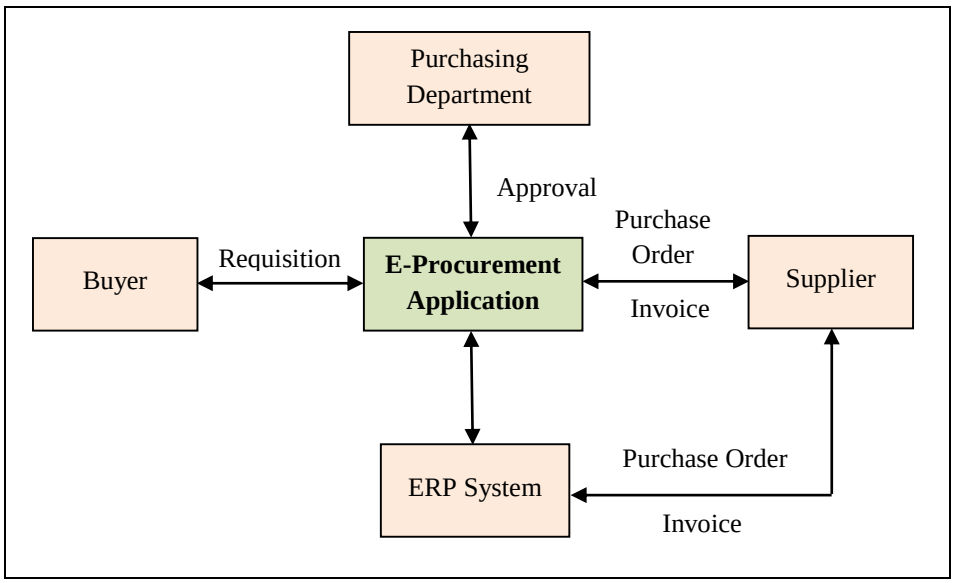
E-Procurement applications can be classified as follows:

- Requisitioning applications
- Centralized procurement management applications
- Supplier applications

Requisitioning applications requisitioning applications simplify the process of purchasing by allowing authorized buyers/ employees to perform all the

purchasing activities from their desktops. These applications integrate the firms' systems, with the systems of the suppliers. With such software, users get product information from customized electronic catalogs that list selected suppliers; the purchase request is routed internally for approval before it becomes an order, sent to the supplier. For this, the firm's intranet and the suppliers' E-commerce sites are linked up. A graphical representation of the E-Procurement process is shown in Figure 18.1.

Figure 18.1: Procurement Using Buy side Requisition Application



Source: ICFAI Research Center

The requisitioning process using an E-Procurement application consists of the following steps:

- Each user in the purchasing firm is given a secure login, based on his profile so that he can order only those products that he is authorized to purchase.
- Users browse the pre-approved multiple suppliers' electronic catalog and select the required items.
- On selection of the items, user can fill and submit the purchase requisition form, which may contain products from one or more suppliers.
- In some cases, the users are allowed to access the e-marketplace applications and 'Punchout sites' directly. 'Punchout sites' are those sites, which are outside the purview of the e-procurement application, which users can access, browse the site's catalog, choose the items, and add to the requisition without leaving the requisition application. For example, Dell offers authenticated access to its premium pages, for its clients. The buyers from the clients can access the customized catalog on Dell's website. They can select the required items and add them to their requisition, without leaving their requisition application.

- Controls in the system ensure that the order size and price do not exceed the user's limit. If the order exceeds the user limit, the order is re-routed, for additional approvals.
- The approvers are informed about the request through email. The approver has the option of approving, rejecting, or putting the request on hold. If the request limit exceeds the approver's limits, it is sent to another approver (usually a higher official). Such controls minimize errors or fraud.
- If the request is approved, either the purchase order is sent to the supplier's systems, directly by the e-procurement application, or the order is submitted to the ERP system, which in turn places the order to the supplier. If the order contains items from a single supplier, the application/ ERP system directly transmits the order via the Internet, to the relevant supplier. If the order contains items, from more than one supplier, it is broken down into one purchase order per supplier and transmitted via the Internet to each supplier in a format that can be understood by supplier systems.
- Copies of order requests are also sent to purchasing systems, for record-keeping. Order acknowledgment, order status, and order shipment notice are sent by the supplier, as he processes the order. These applications also enable the users, to track the order status.

There are certain issues that are to be addressed while implementing these systems. If companies already have ERP systems, they need to be integrated with the E-Procurement applications for better results. The supplier's systems should also be compatible with the firm's systems, so that creating and updating the supplier's catalog, and sending and receiving purchase orders can be performed smoothly. The firm has to maintain the catalog and update it regularly, so that purchase personnel can get the latest information regarding the products, their availability, and price.

Centralized Procurement Management Applications (CPMAs)

While requisition applications facilitate the automation of various purchasing functions, CPMAs enable procurement managers to effectively manage the procurement process, by analyzing vast amounts of transactional data. They aid purchase professionals in carrying out spend analysis. Spend analysis and planning provide information such as: what products did the firm buy; from whom, and in what quantity did it buy; and what is the spending with each supplier, etc. Such information helps in taking decisions relating to purchase and supplier management. These applications also help in aggregating multiple supplier catalogs, into a single centralized catalog.

CPMAs have four functionalities: data collection, multidimensional analysis, supplier management decisions, and configuration of spending controls.

Data collection

Proper data collection is essential for any analysis. CPMAs collect and maintain data, on various purchasing activities. This data includes actual spending against budgeted spending, spending according to the geographical area, spending for each supplier, spending pending approvals, past spending data for a week, month, and quarter, items received, compliance of supplier regarding on-time delivery, etc.

Multidimensional analysis

The Multidimensional analysis enables procurement professionals, to better understand the pattern of procurement spending, in the light of the firm's requirements and market conditions. Purchasers develop forecasts and trends, based on the data presented in the online analytical processing (OLAP) reports. With the help of these applications, professionals can generate OLAP reports, in a format that aids in making decisions on purchases.

Supply management decisions

Using this module, a firm can take various decisions, relating to supplier management. With this module, the buyer can decide on the products to be included in the catalog, products that need to be removed from the catalog, products whose purchases must be curtailed, products whose prices must be renegotiated with the suppliers, etc.

Configuration of spending controls

Using this module, the firm can configure the spending controls based on the above analysis. It can make real-time changes to catalogs and workflow so that the spending pattern is in line with the spending and business objectives.

Supplier applications

Supplier applications, or sell-side applications, help manufacturers and distributors, to sell their products over the web. Using these applications, firms can build storefronts and online marketplaces, on the Internet. In a typical online marketplace set up, the product catalogs of various suppliers are aggregated and hosted on a secure website. Buyers search this aggregated catalog and compare the products offered by different suppliers, to obtain the required product at the lowest cost. The success of such marketplaces depends on the following factors:

i. The supplier systems must be integrated with the website systems, for seamless information flow.

ii. Product information has to be maintained and updated regularly.

iii. The site interface should be browser-based so that all customers can access the site without difficulty.

iv. The site infrastructure should be scalable so that it can handle growth, in terms of volumes and customers.

There are various forms of sell-side applications that are used in the industry. Let us examine some of them.

Supplier storefront

Similar to B2C retailing sites, these sites contain a single supplier catalog, hosted on a website, which is accessed by buyer organizations. A good B2B site offers customization features for each customer, such as customer-specific product catalogs, contract pricing, and tailor-made electronic invoice delivery and reporting facilities.

Dell offers the corporate customers premium pages, which consist of tailor-made product catalogs and other options, which are customized to the requirements of the customer. It provides support to 20 different e-procurement applications such as Peoplesoft, Peregrine, and Oracle, so that it can cater to the needs of a large customer base.

Exchanges and auction marketplaces

Exchanges and auction market places are portals, where different firms can obtain information and also buy and sell products. The purpose of these marketplaces is to reduce costs, through aggregating buying power, bring about better collaboration between firms of a particular sector, and provide a platform to those companies, which cannot take advantage of the benefits of e-procurement on their own.

There are three types of markets based on ownership:

1. Private exchange
2. Industry consortium
3. Independent e-markets.

Private exchanges facilitate one-to-many relationships between trading partners. They can be either a single buyer-many supplier set up or a single supplier-many buyers setup. Since these marketplaces deal with few members, they support strong collaboration.

Industry consortiums are mainly vertical marketplaces, where firms in a particular industry carry out transactions. Examples of industry consortiums include PlasticsNet.com, Chemconnect, and Covisint.

Independent marketplaces are operated by neutral firms, who act as infomediaries, between the buyers and sellers and establish many-to-many connections. These are likely to have the highest range of participants due to their neutrality. Apart from supporting the usual buy-sell transactions, marketplaces also can function as spot markets, where firms can clear off their excess inventory at a low cost. Since multiple buyers and sellers can be brought together at one time, they are also suitable for the auction of products.

Auctions can be of two types: Forward auctions and reverse auctions. In a forward auction, the seller first offers goods or services, and then the buyers bid for them. In a reverse auction, the buyer requests quotes from suppliers, for the products he wants to buy and then the suppliers provide the rates, at which they can supply.

There are reasons why buyers and suppliers participate in B2B marketplaces. Some of these are:

- For buyers, who cannot invest large amounts in buyer side e-procurement software, participating in a marketplace can give the benefits of e-procurement, with a low investment.
- Large companies can use their buyer side software, to gain access to a large number of suppliers.
- Due to the aggregation of buyer power, buyers can get products at competitive prices.
- Marketplaces help buyers, who are in sudden need of a particular product by providing access to a variety of suppliers, who provide a wide range of products. Thus, a marketplace matches surplus supply, with unmet demand.

Some of the motivating factors for suppliers, to participate in B2B marketplace are:

- Suppliers can reach out, to a large number of customers, at a low cost.
- Small suppliers can compete on equal terms with large suppliers.
- Marketplaces allow sellers to liquidate excess stocks, easily and quickly.

18.5.3 E-Collaboration

E-Collaboration can be defined as business to business interactions over the Internet. These interactions are not limited to buy and sell transactions, but also include activities, such as information sharing, collaborative planning, and collaborative new product development. Information sharing leads to better coordination, among the trading partners. Collaborative planning enables group decision-making, i.e., all the members of the supply chain can participate in the decision-making process, through an efficient and effective exchange of knowledge. Collaborative new product development enables faster product development. E-Collaboration applications can impact the supply chain operations, in many ways. Let us examine some of them.

Information sharing

E-business enables the sharing of key information, among the trading partners spread across the supply chain. Information shared includes demand data, inventory status, production schedules, promotion plans, shipment details, etc.

For effective coordination among the supply chain partners, timely and accurate information sharing is necessary. Information sharing is critical, to mitigate the bull-whip effect or the distortion of demand information in supply chains.

The internet is an ideal medium, through which supply chain members can share information on a real-time basis, thereby reducing information distortion. The features of the Internet, like open standards, universality, security, easy access to all members at low cost, make it an ideal medium to share information.

Collaborative planning

Collaborative planning involves the combined efforts of a group of people, teams or firms, spread across the supply chain. It requires knowledge sharing, by the trading partners in the supply chain, to prepare forecasts and replenishment plans.

One approach to collaborative planning is the collaborative planning, forecasting, and replenishment (CPFR) approach. CPFR is an e-business approach that advocates planning of business, from a customer-specific demand perspective, rather than a top-down market and brand perspective. CPFR operates as a set of business processes, in which trading partners agree to mutual business processes and measures, development of joint sales and operational plans, and collaborate to generate and update sales forecasts and replenishment plans.

E-commerce collaborative applications facilitate collaborative planning, by increasing the level of communication between various supply chain partners. They exchange product forecasts and replenishment plans, and the software develops new plans, to match supply with demand. .

Collaborative new product development

E-business applications enable faster and timely new product development, which is critical as product life cycles are becoming shorter. There are many applications, which aid in the faster and timely development of new products, which enable engineers, product managers, and marketing executives to interact in real-time, to design and develop new products. It also makes it possible for teams to share documents and complex 3D drawings, and schedule and manage meetings online, resulting in substantial cost savings and reduced time to develop and market the product.

Example: An e-Commerce Application for Better Customer Service

aCommerce was a leading e-commerce business group from Southeast Asia. They served e-commerce solutions for a la carte brands in Thailand, Singapore, Malaysia, Indonesia, and the Philippines. It communicated on over 150 brands with over 120 million end customers.

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These messages were related to package tracking, status of sales orders, marketing promotions etc, and they adopted 8x8 SMS APIS instead of email approach. The aCommerce team analysed that the 8x8 SMS APIs platform was easy to use, had a flexible structure, and easy to implement. Advance scheduling of notifications by 8x8, simplified the workflows for aCommerce team.

aCommerce team used SMS as a complement to other marketing platforms. 8x8's real-time communication helped aCommerce to automate messages about marketing promotions, updates, discounts, and marketing campaigns easily. This led to increased conversion rate and enhanced customer engagement. This helped aCommerce management to channelize the efforts of manpower more towards planning business activities and operational workflows, leading to improved business efficiency. 8x8 SMS APIs helped aCommerce, to focus on serving their brands, and achieving exemplary customer experience.

Sources: i) https://www.cxtoday.com/contact-centre/8-insightful-e-commerce-case-studies-to-read-in-2022/ March 2022, Accessed on 15/09/22

ii) https://www.8x8.com/resources/customer-stories/acommerce

18.6 Implementing the E-Business Proposition

Implementing e-business solutions to redefine supply chain practices is not an easy task. For this, a firm has to consider many factors. It has to analyze its Internet capabilities and identify the areas, where these capabilities can fit in its overall business strategy. The firm has to think from a supply chain perspective, to gain maximum benefits from e-business initiatives. First of all, it has to understand the implications of e-business on the organization's strategy and that of its competitors. It should also evaluate how e-business affects the value of the company and its supply chain. Later, it has to make an internal effective assessment and an external effective assessment. Internal effective assessment includes an evaluation of the internal environment in the organization, to make it ready for the implementation of e-business. In this assessment, the firm focuses on three areas - people, facilities, and processes. External assessment involves the level of supply chain integration between the firm, its trading partners and its customers. Inputs from the assessment are used, in the process of implementation of the e-business proposition.

E-business initiatives should be carried out in a phased manner. First, the firm has to focus on reducing costs; this brings quick returns for the organization. At this stage, the establishment of the IT infrastructure is an appropriate option. Also, the installation of ERP solutions can be carried out. At the next stage, the ERP system can be aligned with the intranet, to facilitate internal information flow. Then the intranet can be connected with extranets, for external information flow with suppliers and customers.

For effective implementation of e-business, the firm may take the following measures.

18.6.1 Start with an Enterprise-Wide Strategy-Driven from the Top

E-business impacts every business process and department across the enterprise. It affects all the business processes starting from the development of a new product to its sales and distribution. Essentially, e-business affects the way the firm interacts with its customers and trading partners. So, to make the enterprise ready for e-business, the initiative has to be taken by the top management. Without the backing and guidance of top management, e-business cannot be successfully implemented.

18.6.2 Removing Bottlenecks in Information Flow

A major barrier to e-business initiatives is restrictions on information flow between departments and across the supply chain. To match the pace of the Internet, a firm's decision-making process should be speeded up. This requires faster sharing of key information. If the firm restricts the flow of critical information within the organization or across the supply chain, it may not be able to implement e-business initiatives successfully. Firms may organize themselves around the business processes. The Internet enables the firms to develop extended enterprises, where the manufacturer, supplier, and logistics service provider are connected, to form a community. But the extended enterprise needs to be supported by extended processes.

If the firm tries to align its business processes across the functional units and integrate these processes with the trading partners without a proper plan, these initiatives may not achieve the desired results. Therefore, firms within a supply chain should organize themselves around business processes rather than around product lines or functional departments.

18.6.3 Integrating Business Processes with Trading Partners

An ideal extended enterprise is one, where business processes are integrated. Thus, a firm should integrate its business processes, and not just IT systems, with those of its business partners. To achieve this, the firm has to first integrate its internal business processes. Later, it should go for advanced business process integration software, which enables process integration between companies.

Example: How to improve conversion in e-business

All e-business organizations were aware of the most common problem of a prospect leaving the page before completion of placing the order. The Envelopes.com team was deciding on best times to send email to prospects and customers of this category, as they were confident about results of sales on targeted follow-up emails.

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They tried out sending email at two different time lapses, after the cart abandonment on their e-business site. First set the following morning at 11 a.m. (Cat-1) and the second one after 48 hours (Cat-2) of cart abandonment.

The results were as follows:

- Cat-1 emails: They realized 38.63% were opened, observed click-through rate of 19.54% and conversion rate towards sale as 27.66%
- Car-2 emails: Achieved an open rate of 38.01%, had a click-through rate of 24.71% and could gain a conversion rate of 40.00%

This reflected that, conversion to sale was significantly higher in second case, Cat-2. Thus, it was arrived at that, sending a follow-up email for those individuals abandoning the carts did reflect in results, and needed to be done. A different time lag and cadence might work better based on the nature of product, and customer base.

Source: https://www.coredna.com/blogs/ecommerce-case-studies February 2022, Accessed on 15/09/22

Activity 18.2

With increasing dependence on outsourcing and focus on core competencies, firms are focusing on procuring materials, products, and services from qualified sources. The internet has facilitated the process of E-Procurement.

- Explain in detail the process of E-Procurement and its advantages, over the traditional procurement process

Check Your Progress - 2

6. Identify the best option, to describe the advantage of e-business in revenue maximization.
   a. Provides direct marketing channel
   b. Round the clock access to customers
   c. Aggregation of information
   d. Personalization and customization
   e. Mass Communication
7. Which, of the following statements, best describes the cost impact of e-business?
   a. Reduced product handling with a shorter supply chain
   b. Enables movement of digital goods

c. Reduced facility and procurement costs
d. Reduced investments through aggregation
e. Improved Information flow

8. Which, of the following, is a main disadvantage of e-business?
   a. Increase in outbound transportation and handling costs
   b. Increase in inventory carrying costs
   c. Decrease in profitability
   d. High costs of communication with partners
   e. Increase in marketing costs
9. E-procurement increases efficiency, because of which of the following?
   a. Lowering procurement costs
   b. Decreasing lead time
   c. Reduced unauthorized buying
   d. Organizing information
   e. Integrating back-office with the procurement function
10. Which, of the following statements, best describes E-Collaboration?
   a. It is business-to-business communication over the internet
   b. It is buy and sell on the internet
   c. It is information sharing on the internet
   d. It is collaborative planning
   e. It is collaborative new product development

18.7 Summary

- E-business is a collection of business models and processes motivated by internet technology. Its focus is on the improvement of extended enterprise performance.
- E-business can help firms to share information, across the supply chain and respond to changes in a range of variables like customer demand, and shortages at the customer, supplier levels, etc.
- Using e-business, firms can implement supply chain concepts more effectively. Supply chain concepts include information sharing, cross-enterprise collaboration, mass customization, outsourcing, partnerships and strategic alliances.
- The Internet is an ideal medium for carrying out many of the supply chain operations, because of the many advantages it has over other communication media.
- In this unit, we discussed the impact of e-business on the supply chain, from revenue and cost perspectives.

- Some of the revenue-maximizing opportunities that e-business offers are the provision of direct channels to customers, round the clock access to customers from any location, possibility of aggregating information from various sources, provision of personalization and customization features, the possibility of faster time to market, and flexibility in allowing price and service discrimination.
- We looked at the impact from a cost perspective. Some of the cost minimization opportunities brought about by e-business are reduction in handling, processing and facility costs, improvement in information flow, the possibility for movement of digital goods, and scope for product differentiation postponement.
- We examined various types of e-business applications that are used in supply chain operations.
- There are three key types of e-business applications: e-commerce, e-procurement, and e-collaboration.
- E-commerce is concerned with the order fulfillment process, where the applications help in coordinating activities among the trading partners, to fulfill the customer demand.
- E-procurement enables the purchasing of the components and raw materials, over the Internet.
- E-collaboration enables the firm to share information, among the supply chain members.
- Finally we looked at the process of implementing the e-business proposition.

18.8 Glossary

CPMA: Centralized Procurement Management Application

Dynamic pricing: It is the process in e-business, by which, a firm can change its prices quickly and simply, just by changing the price information in its website's product database.

E-business: is a collection of business models and processes motivated by Internet technology, and focusing on improvement of extended enterprise performance.

E-collaboration: can be defined as business-to-business interactions, over the Internet.

E-commerce: E-commerce is concerned with the order fulfillment process, where the applications help in coordinating activities among trading partners.

Electronic data interchange (EDI): EDI was the most popular information sharing platform prior to the advent of the internet.

E-procurement: E-procurement deals with automating all the purchasing functions, from purchase requisition to payment transaction.

Order fulfilment: It is the process of coordinating activities among the trading partners, to meet customer demand.

18.9 Self-Assessment Test

1. Discuss in detail the impact of the internet and e-business on the supply chain.
2. What are different types of e-business applications and what are their features?
3. What are the challenges in implementing the e-business proposition?
4. What is E-procurement? Discuss its advantages and disadvantages.
5. What is E-collaboration? Elaborate with examples.

18.10 Suggested Reading / Reference Material

1. Ashley McDonough, Operations and Supply Chain Management Essentials You Always Wanted to Know: 15 (Self Learning Management Series) Paperback – 1 January 2020.
2. Russel and Taylor, Operations and Supply Chain Management, 10 ed, ISV Paperback – October 2019.
3. Chopra and Kalra, Supply Chain Management 6/e Paperback – 17 June 2016.

18.11 Answers to Check Your Progress Questions

1. (a) Improvement of extended enterprise performance

It is the focus of e-business applications.

2. (b) It is a collection of business models supported by internet technology

This is the best way of describing e-business.

3. (e) Enables many to many real-time communication

It is the best feature of the internet in supply chain management.

4. (d) Compresses the supply chain

It is the best advantage of the internet in supply chain management.

5. (d) Enables the visualization of information across the supply chain

This is the best advantage of e-business.

6. (c) Aggregation of information

It is the best advantage of e-business in revenue aggregation.

7. (a) Reduced product handling with a shorter supply chain

This statement best describes the cost impact of e-business.

8. (a) Increase in outbound transportation and handling costs

It is the main disadvantage of e-business.

9. (e) Integrating back office with the procurement function

This feature increases the efficiency of lowering procurement costs.

10. (a) It is business-to-business communication over the internet

It is called e-collaboration.

Unit 19

Financial Flow in a Supply Chain

Structures

"*I do not look at the numbers from a finance perspective. Instead, I look at what the customer is trying to tell us".*

- Peter Georgacopoulos – Retail and ecommerce executive

19.1 Introduction

There is considerable number of intermediaries synergizing the supply chain operations and naturally looking for timely financial flow for their fulfilled operations. While good negotiations by the parent organization is critical, the focus ultimately needs to be on the fulfillment of all customer requirements with respect to time, quality schedule, packaging, temperature control, correct quantity delivery etc., while supporting the stakeholders.

In the previous unit, we discussed the impact of e-business on a supply chain and the various e-business applications that can be used to enhance the efficiency and effectiveness of a supply chain. The coverage includes the impact of the Internet on the supply chain, the impact of e-business on the supply chain, from revenue and cost perspectives, various forms of e-business applications that are widely used in supply chain operations, and the way the e-business proposition is implemented.

Financial flow is an important flow, in any supply chain [apart from material and information flows]. Firms, in the past, focused mainly on improving the material flow in their supply chains. But with opportunities for saving cost and making profits, arising from improving the financial flow, firms have begun to streamline the financial flow as well. Technological advances that facilitate automation have

enabled firms to improve their financial flow. Flow of cash, in a supply chain, consists of collection of payments from customers, by the goods manufacturer or service provider, and payments by them to their suppliers. An efficient financial flow can help the firm in reducing inventory, increasing cash flow, improving collaboration between the supply chain partners, and enhancing customer satisfaction.

In this unit, we first discuss the components of a financial flow and how they can be improved. Then, we examine the various options available for automating financial flow, in a supply chain. Finally, we discuss the ways, by which integration of material and financial flows can be achieved.

19.2 Objectives

By the end of the unit, you will be able to:

- Identify the components of financial flow in a supply chain
- Explain automating financial flow in a supply chain
- Discuss integrating material and financial flow in a supply chain

19.3 Components of Financial Flow in a Supply Chain

There are two key components that constitute financial flow in a supply chain. They are:

- Purchase-to-pay process,
- Order-to-cash process.

Purchase- to-pay process. This component of financial flow in a supply chain consists of all financial transactions, with the suppliers

Order-to-cash process of financial flow in a supply chain consists of financial transactions, with the customers.

Efficient management of cash flow in these two processes can improve the profitability of the supply chain. This involves the faster collection of the account's receivables and efficient management of accounts payable.

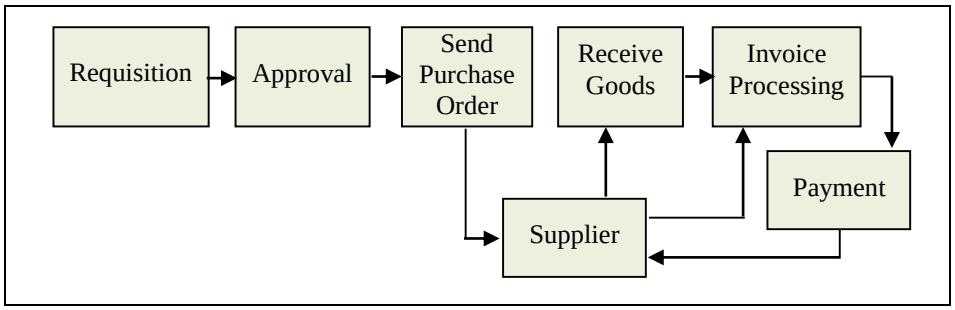
In this section, we discuss both the processes in detail and the ways of speeding them up, to achieve cost savings and profitability.

19.3.1 Purchase-To-Pay Process (PTP)

The buyer organization initiates a purchase requisition and it is submitted to the purchase department for approval. Then, a purchase order is placed on the supplier. The goods are sent to the buyer along with the invoice. The goods, invoice, etc. are verified by the buyer, to ensure that the goods received are as per the requirements specified in the purchase order, including product quality and quantity ordered. After the consignment received is confirmed as per the above requirements, the payment is made by the accounts department to the supplier.

Thus, the Purchase-To-Pay process starts with the buyer making the requisition and ends with the payment to the supplier. Figure 19.1 describes the Purchase-To-Pay process.

Figure 19.1: Purchase-To-Pay-Process



Source: ICFAI Research Center

Some measures, to improve the efficiency of purchasing transactions in supply chain management, are discussed below.

Focus on reducing parameters like processing time and costs

There are many methods to reduce processing time and processing costs for expediting the purchasing process. Firms should empower the purchase manager to order goods, up to a certain permissible limit, without further approvals. This reduces the time and costs involved in the entire process of routing and approving the purchase orders. In cases, where the purchase requisitions are approved before the order is placed with the supplier, the need for approval again at the time of payment to the supplier may not be insisted, to reduce delay and speed up the purchasing process.

Use of Evaluated Receipt Settlement (ERS). After receiving the goods, the buyer compares the packing slip and the goods, with the purchase order. The amount is calculated, based on the price quoted in the purchase order and then payment is made, to the supplier. Thus, the firm pays the supplier for what it receives, without the need for an invoice. This reduces the time and costs in matching the invoices and the errors that occur due to repeated data entry.

Use of electronic invoicing. Electronic invoice reduces paperwork and processing costs, at the same time reducing the errors and disputes that arise due to manual processing.

Performance management

A well-established performance management system is essential to effectively measure the PTP process. This provides opportunities for improvement through some inputs, to make the PTP process more efficient. Two popular types of performance metrics in the PTP process are:

i. Top-down performance metrics measure the overall performance of the PTP process. Top-down metrics include a percentage of payments made through

checks and electronic payments, processing costs incurred, purchase order error rates, etc.

ii. Bottom-up performance metrics measure individual or team performance. Bottom-up metrics include time taken for processing each payment voucher, processing cost per invoice, etc.

The selected metrics should be aligned with the goals set by the firm. The metrics are measured against the goals set to analyze the extent to which they have been achieved.

Automation of the PTP process

A firm can enhance the efficiency of the PTP process, through automation.

i. Firms can implement an E-procurement system, to streamline the purchasing process. But an E-procurement can only improve the physical process of purchasing and not the financial processes.

ii. Many ERP systems contain various modules of the PTP process that may help in the automation of financial components.

iii. Another application that supports the automation of financial processes is electronic invoice presentment and payment (EIPP) systems. EIPP systems enable suppliers and buyers to exchange invoices, resolve disputes, and make payments electronically. Thus, these systems enable collaboration, between supply chain partners. EIPP systems need to be integrated with the internal systems like procurement, ERP, and accounts payable, for effective functioning.

Outsourcing

Another option employed by firms is to outsource some of the components of the PTP process to a third party. This will help the firm to achieve cost savings and faster processing. Many financial institutions offer cash management services like receiving invoices, check printing, dispute handling, reporting & analysis, managing international payments, electronic funds transfer, supplier management, etc. In some firms, the entire PTP process is outsourced due to some advantages as given below.

i. Outsourcing provides the firm flexibility and ability to scale up the operations, as and when needed.

ii. Outsourcing time-consuming and routine activities can help a firm, to focus more on strategic functions and the personnel can be used for productive purposes.

iii. The risks involved can be reduced, by sharing the operations with a third party.

19.3.2 Order-to-Cash Process

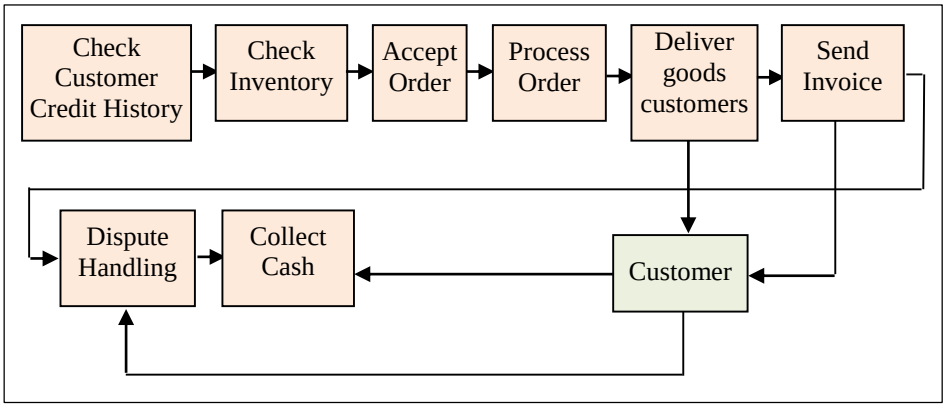
Order-to-cash process starts with the customer placing the order and ends with receiving the payment from the customer. The steps involved in the order-to-cash process are explained below.

The order is placed by the customer directly through phone, fax, or the Internet. Then, the inventory is checked for the availability of the product in the quantity required by the customer. The firm then checks the customer credit status to decide, whether or not to extend credit to the customer. For this, the customer's credit limit and the status of receivables from the customer are checked. If the customer has placed the order within the credit limits and has nil or permissible receivables, then the product can be delivered to the customer. If not, the firm has to evaluate, whether to fulfill the order or to reject it or put it on hold. If it is a new customer, the firm has to establish a new credit line for the customer. If the customer is an existing one and has a high credit risk, then the order may be rejected. If the order is placed by an existing customer having low credit risk, then the order may be put on hold for further analysis.

After delivering the goods, the customer is billed and the invoice is sent to the customer. The disputes that are raised by the customer are then examined and resolved. Finally, the collection of the payment is done, either at the convenience of the customer or as per rules and norms set by the firm.

Figure 19.2 describes the order-to-cash process.

Figure 19.2: Order-to-Cash Process



Source: ICFAI Research Center

By expediting the order-to-cash process, cash flows can be improved. Some of the steps that can be carried out to expedite the order-to-cash process are as follows:

- Review of processes and procedures
- Identifying the processes that are fit for automation
- Developing appropriate performance metrics
- Designing an effective reporting system

Review of processes and procedures

B2B (Business to Business) firms generally provide goods on credit to the customers. In most cases, credit is interest-free and the firm has to bear the credit costs. Firms, therefore, have to carefully evaluate and set guidelines for providing credit to the customers. Firms may have to provide credit on liberal terms. Yet, at the same time, they have to make sure that the bad debts generated on account of those liberal policies are kept under control. While developing the credit policy and procedures, several factors have to be considered. Credit policy needs to take into account the industry within which the firm is operating and its size. Big retailers wield more power, thus forcing the suppliers to make their policies towards such firms liberal. The firm should also consider customer preferences and requirements. It has to evaluate its competitive environment and develop a credit policy that differentiates it from its competitors. It also needs to develop credit risk analysis guidelines, which enable it to evaluate a customer, while providing the credit.

There are four key types of credit policies, which a firm can adopt. The first type of credit policy puts high credit risk limits and stringent measures of collection. In such a policy, the firm only accepts those customers, who have a good credit history and high credit ratings. At the same time, the firm may also have strict collection policies such as imposing penalties and fines, for late payments. Such a policy enables the firm to obtain payments faster and reduces the risk of high bad debt. But this policy is not customer-friendly.

The second type of policy is to be liberal in providing credit but strict in collecting dues. In such a policy, the firm accepts customers with even low credit ratings but the collection will be strict and no kind of lenience towards the customers is allowed, in the collection policy. Such a policy is customer friendly but it increases the collection costs and the risk of bad debts.

The third kind of credit policy allows only customers with high credit ratings, but has liberal collection policies. The idea behind such a policy is that a customer, with a good track record, will pay the dues promptly; therefore, making the collection process liberal will not have any impact on the receivables. But such a policy is not advisable for firms, which handle large orders.

The fourth kind of credit policy allows customers with low credit ratings, and a liberal collection policy. Such a policy may increase the risk of bad debts and the collection process may take a long time and become tedious. This policy is advisable when the firm wants to increase its market share. The firm has to choose an optimal credit policy, which, while being customer-friendly, does not impede the collection process.

Automating receivables management

Another important step in enhancing the efficiency of receivables management is the automation of a part or the whole of the process. By automating receivables

management, a firm can track and monitor the receivables and evaluate how the receivables process can be improved. Automation helps in faster and more accurate risk assessment of customers. Firms can easily distinguish between customers, with low credit profiles and customers, with high credit profiles. This enables the firm to decide upon the customers, to whom credit can safely be extended. Activities like payments and credit analysis can be automated, to reduce time and costs and to improve the receivables collection and management.

Developing relevant performance metrics

Developing relevant performance metrics helps the firm assess the effectiveness of the receivable's management process. It can also help the firm identify opportunities, to improve the process. Performance measures are needed for all the elements of order-to-cash process, and should be developed in line with organizational objectives. They should also be based on industry standards. By matching the measures to the industry standards, a firm can analyze its position in relation to its competitors, and take necessary action to improve upon those measures. Days Sales Outstanding (DSO) is the key measure that is generally used to evaluate the order-to-cash process. However, there are other metrics, related to each step in the order-to-cash process that can be measured for better performance analysis. They are:

- Percentage of invoice errors
- Percentage of bad debts
- Average time taken for credit approval
- Percentage of orders executed perfectly
- Percentage of cash collected, within the stipulated credit terms
- Percentage of invoices issued manually
- Percentage of invoices issued electronically

Developing an effective reporting system

Information needs to be shared between different departments, for efficient receivables management. Proper information sharing enables the departments, to have accurate and up-to-date information, which in turn helps them to take timely action. For example, a customer holds back payment, due to quality or quantity issues. This information is first received by the account's receivables department. If this information is communicated to the manufacturing department, it can take timely action to improve the quality of the products. This would help the firm collect receivables and also resolve customer grievances faster. This information needs to be shared, with other supply chain partners like logistics service providers and financial institutions as well. As customers expect timely and accurate order delivery, any deviations can delay the payment process. An effective reporting system would help provide accurate information to the supply chain partners, so that the right order can be delivered to the customer, on time.

Example: Supply Chain Finance at an Automotive Parts Company

Genuine Parts Company (GPC), an automotive and industrial parts supplier, prioritized customers and suppliers in all their business decisions and earned reputation for best corporate culture. During pandemic times, many of the GPC suppliers faced financial challenges, affordable capital etc. This historic disruption prompted GPC to rethink about supply chain finance.

GPC's treasury team created a cross functional group to expand the Prime Revenue-led supply chain finance program. This helped improve Days Payable Outstanding (DPO), metrics of cash conversion cycle, and increased cash demand for all suppliers of all regions. GPC could rope in new funding partners, which increased the coverage, and developed long-term funding relationships. These relationships could help leverage capital and treasury needs in the future for GPC. GPC team institutionalized working capital objectives with focus on accountability. It improved cash conversion cycle, facilitated better supplier payment terms by promoting early payments through available supply chain finance.

GPC's Prime Revenue-led supply chain finance program gave suppliers enhanced and better visibility into invoices approved, credit and remittance memos, and reiterated 'customer- and supplier-first 'culture at GPC. In partnership with Prime Revenue the company's DPO improved from 39 days to 135 days. GPC's cash conversion cycle could improve from 133 days to 11 days. The expanded supply chain finance program eased the supplier's access to needed and affordable capital. The program had materially improved financial metrics leading to desired financial stability and flexibility, both to GPC and their global suppliers

Source: https://primerevenue.com/resources/case-studies/genuine-parts-company-improves-supplier-health-and-financial-flexibility/ November 2021, Accessed on 15/09/22

Activity 19.1

Financial flow is an important flow in any supply chain, along with material and information flows. Firms in the past, focused mainly on improving the material flow, in their supply chains. But due to the need and opportunities for saving cost and making profits, firms have begun to streamline the financial flow as well.

- Identify the key components of financial flow, in a supply chain.
- Examine the ways, to improve the financial flow in supply chains.

Check Your Progress - 1

1. Which of the following is not a defined stage in the Purchase-to-Pay Process (PTP)?
   a. Send purchase order
   b. Receive goods
   c. Inspect
   d. Invoice processing
   e. Receive payment
2. Which of the following is not an advantage of the evaluated receipt settlement (ERS) system?
   a. No need for invoice from the supplier
   b. No negotiations
   c. No delays in the process
   d. Reduces paperwork and costs associated
   e. Customer gets, what he wanted
3. Why is the electronic invoice presentment and payment system advantageous? Cite the most important one.
   a. Reduces paperwork
   b. Reduces processing costs
   c. Reduces errors
   d. Avoids disputes
   e. Increases the speed of processing
4. Which of the following is not a way to improve PTP (Process to Payment) System?
   a. Use of evaluated receipt settlement
   b. Performance management
   c. Direct cash and carry
   d. Automation of PTP process
   e. Outsourcing
5. Identify the stage that is not in the order-to-cash process.
   a. Check customer credit history
   b. Reject the order, if it is a new customer
   c. Accept and Place order on supplier
   d. Deliver goods and send invoice
   e. Collect payment

19.4 Automating Financial Flow in a Supply Chain

One of the key elements, which helps in efficient financial flow in a supply chain, is the use of IT solutions in the purchase-to-pay and order-to-cash processes. By automating these processes, firms can minimize inefficiencies and improve the effectiveness of the supply chain. Some of the prominent IT solutions that are used in automating the financial flow are:

- Electronic invoice presentment and payment (EIPP) solutions
- Electronic trade financing systems
- Credit information and management systems.

19.4.1 Electronic Invoice Presentment and Payment Solutions

EIPP solutions enable the supply chain partners to send or receive invoices and make payments electronically. Such an arrangement is advantageous, for both the supplier and the buyer. The buyer can readily compare the invoice, with the purchase order information stored in his system. The supplier benefits from such an arrangement, as the documents are in an electronic form that can be tracked and managed easily. Access to updated information regarding orders enables disputes to be resolved easily and errors to be reduced significantly.

EIPP Implementation models

There are three models of EIPP implementation: supplier model, buyer model, and consolidator model.

Supplier's EIPP model: In this model, the supplier or seller controls the EIPP system. The EIPP system is linked, with the accounts receivables system of the supplier. The relationship between the supplier and buyer is one-to-many, i.e., the seller's EIPP system is accessed by multiple buyers. Thus, the invoice presentment is done by the seller to many buyers. The buyers are required to, or encouraged to log on to the seller's EIPP system, to access the invoice information. The buyer is informed about new invoices through email. The processes in the seller's model are as follows:

i The buyer needs to register, to gain access to the supplier's EIPP system.

ii The supplier generates an invoice and stores the information in the EIPP system. Then, the supplier informs the buyer about the invoice.

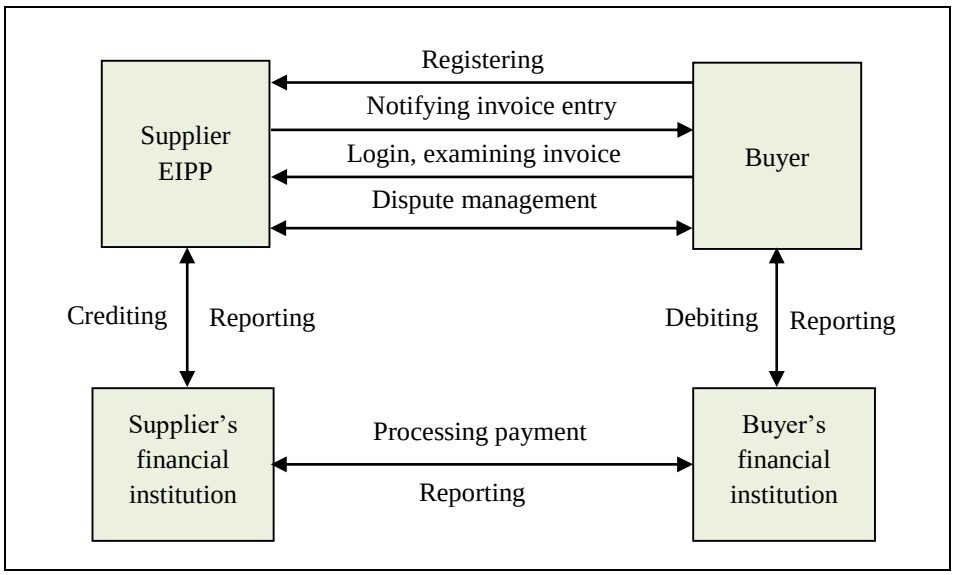
iii The buyer logs on to the supplier's web site and examines the invoices related to his transactions.

iv Any dispute regarding the invoice can be intimated to the supplier through email. The disputes are evaluated based on the workflow and business rules. A dispute is rejected if it does not match the rules. It is accepted if it is valid, and in accordance with the rules, set by the supplier.

v Once the dispute is resolved amicably, the buyer authorizes complete or partial payment of the invoice, which will be processed by the supplier's financial institution. The remittance of the payment is then updated in the accounts payable system of the supplier, by the EIPP system. Financial institutions of both the parties exchange the payment processing information, using their respective reporting systems.

Figure 19.3 describes the processes in the supplier EIPP model.

Figure 19.3: Supplier EIPP Model



Adapted from http://cebp.nacha.org/documents/b2b-presentment-models.pdf

This model is suitable when the supplier handles a large volume of invoices. This is more appropriate in industries like manufacturing and telecommunications, where firms have to deal with large volumes of invoices. Thus, by implementing the supplier EIPP model, these firms can manage and control the invoicing process. But, to make it successful, the supplier will have to convince the buyers to use this system. The supplier needs either to be a large player, who can use its influence to make buyers adopt the model or provide some concessions or assistance, which would attract the buyers to adopt this model.

The key benefit from the system for the supplier is that he will be in full control over the invoicing and payment process. The supplier can also do away, with the need for contacting multiple buyers, as the buyers themselves come in contact with the supplier. The downside of this for the supplier is the cost of installing and managing the EIPP system. The supplier has to make the system support multiple data formats of various buyers' systems.

The key benefit for the buyer is the reduction in invoicing costs resulting from the supplier managing the invoicing process. Buyers can also gain from the assistance and concessions provided by the supplier, for adopting this model.

The downside of this for the buyer is that, since the buyer deals with various suppliers, adopting these suppliers' EIPP models may lead to operational problems like accessing multiple suppliers' sites and following different invoicing and payment standards.

Buyer's EIPP model: In this model, the buyer implements and manages the EIPP system. The EIPP system is linked, with the accounts payable system of the buyer. In this model, the relationship between the buyer and suppliers is one-to-many, i.e., one buyer transacts with multiple suppliers. In this model, the buyer encourages the suppliers to send invoices, to the buyer's EIPP system. The invoice flow in this system is as follows:

i First, the supplier registers in the buyer's EIPP system.

ii Then, the supplier posts new invoices on to the system. The posting of invoices is intimated to the buyer.

iii Then, the buyer examines the invoices and looks for any discrepancies in them. If mistakes are present in the invoice, the buyer intimates the same to the supplier.

iv After resolving the disputes, the buyer initiates the payment.

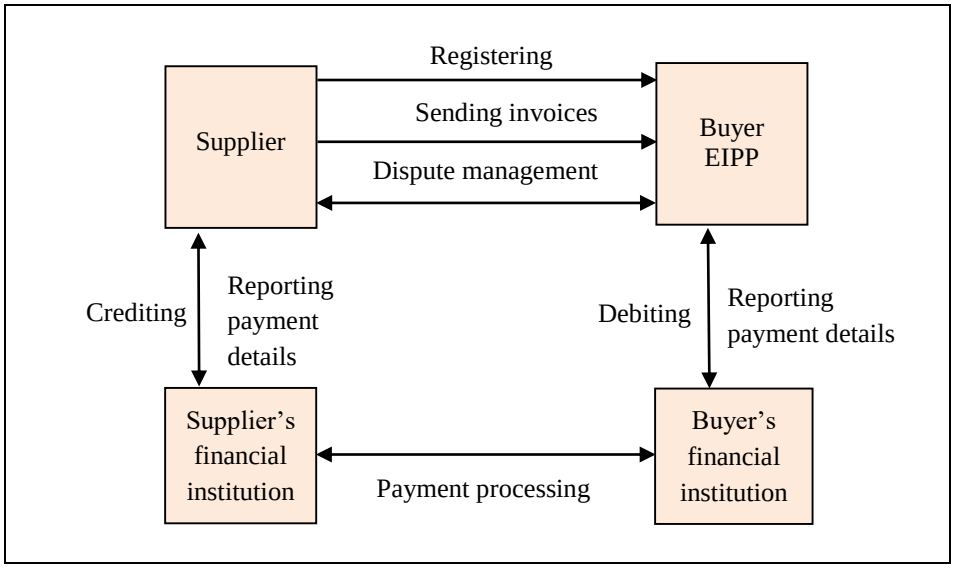
v The payment is processed by the buyer's financial institution.

vi Payment information is then updated, in the accounts payable system of the buyer.

vii The processing and settlement information is passed on, to both the parties by their respective financial institutions.

Figure 19.4 describes the processes in the buyer's EIPP model.

Figure 19.4: Buyer's EIPP Model



Adapted from http://cebp.nacha.org/documents/b2b-presentment-models.pdf

This model is more appropriate, if the buyer deals with a large volume of invoices, as in the case of automotive and manufacturing companies, who deal with invoices from a number of suppliers.

The key benefit for the buyer is that he will be in complete control over the invoicing process including dispute management and payment processing. Buyers can link their EIPP systems, with their other systems like accounts payable and purchasing. They also need not interact with a large number of suppliers, as suppliers themselves post the invoices onto the buyers' EIPP system. However, the buyer has to install and take responsibility for the proper functioning of the system. Buyers should also make sure that the system supports different data formats and standards so that it can deal with a large number of suppliers' systems.

The key benefit for the supplier is that he may receive his payment from the buyer faster, due to electronic submission of the invoice on the buyer's system. Another notable benefit is that the supplier can build a long-term relationship with the customers. Since the supplier has to make arrangements with multiple buyers, it may require the supplier to follow multiple invoicing and payment standards.

Consolidator's EIPP model: In this model, a third-party implements and manages the EIPP system. The set up consists of many-to-many relationships, where multiple buyers transact with multiple suppliers. This enables the buyers as well as the sellers, to eliminate the need for maintaining multiple data formats and payment standards, which is taken care of by the consolidator. The consolidators' EIPP system may also provide other value-added services. The invoice flow, in this model, is as follows:

i The suppliers and buyers register in the consolidator's EIPP system.

ii The supplier sends the invoice to the system, which is intimated to the buyer.

iii The buyer then logs onto the consolidator's EIPP system and checks the invoice.

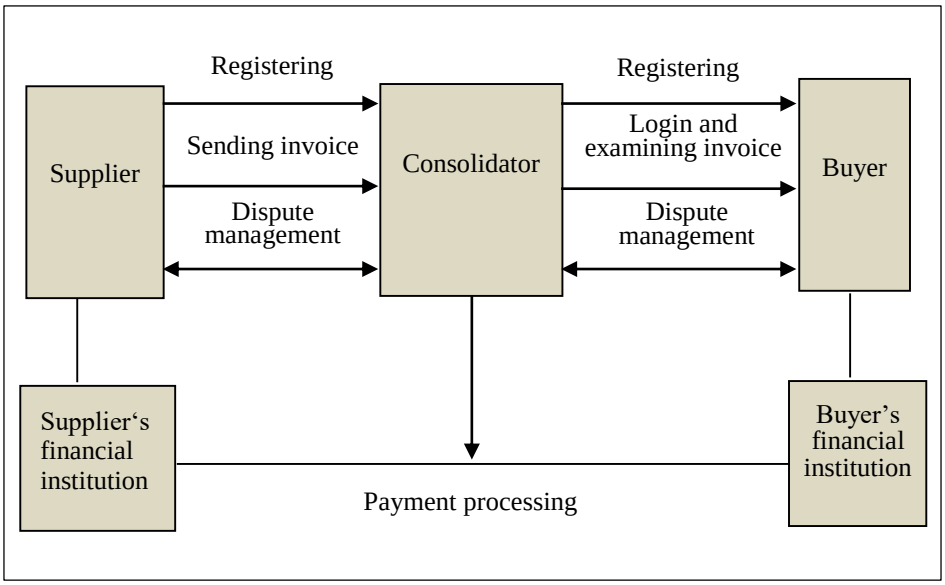
iv If there is any dispute, the buyer intimates the same to the supplier, through the consolidator's EIPP system. The dispute is examined by the supplier and resolved.

v Then, the buyer initiates the payment, which may be processed by either the buyer's financial institution or the supplier's financial institution. In some cases, the consolidator takes responsibility for the payment process also.

vi The consolidator's EIPP system may enable the supplier's accounts receivable system and the buyer's accounts payable system, to be updated with the latest information regarding the invoice.

Figure 19.5 describes processes, in a consolidator's EIPP model.

Figure 19.5: Consolidator's EIPP Model



Adapted from http://cebp.nacha.org/documents/b2b-presentment-models.pdf

With the rising interest in EIPP systems and barriers faced by both buyers and suppliers in implementing EIPP, consolidator's EIPP systems are gaining popularity. The consolidator can link a buyer having a particular data format and payment option, with a supplier having a different data format and payment option. This brings multiple buyers and multiple suppliers on to a single platform.

Benefits of EIPP

The three key benefits of EIPP solutions are as follows:

Efficient payment process: Due to the shifting of manual processes like matching and approval of invoices to electronic processes, the errors that occur in manual re-entry of data can be reduced significantly. Documents can be forwarded according to the set business rules, thus reducing the delay in moving the documents from one department to another. Since the path of the invoice is known, the firm can easily trace and follow up on the invoice.

Reduction in processing costs: Since the invoices are routed and approved electronically, payments can be made to the suppliers promptly. This reduces the workload of the accounts payable department, as the personnel in the department no longer have to attend to inquiries from the suppliers regarding payments. As the transaction processing is made online, the accounts payable department can achieve substantial cost savings and can concentrate on other important activities.

Taking advantage of early payment discounts: An EIPP system can help the firm process the invoices in time and obtain discounts. As these discounts directly

add to the profits, the EIPP system helps in improving the firm's profitability. For example, a supplier may set the price of a product as Rs. 10,000, if paid within 30 days and may give a discount of 5%, if paid within 10 days. Thus, by paying within 10 days, the firm can earn a profit of Rs. 500. Suppliers may also charge a fine, for late payment of invoices. The use of EIPP system can also minimize late payments.

19.4.2 Electronic Trade Financing Systems

Trade finance is generally related to the movement of goods internationally, i.e., import and export of goods. Therefore, trade finance could involve a lot of paperwork, which is time-consuming and complex. But this has been simplified, due to advances in information technology and the emergence of the Internet. Solutions have now been developed to smoothen the process of international trade. There are two prominent solutions available in the market place – Bolero is an example for prominent payment solutionsthat provide faster access to the funds and reduce processing costs. Due to faster processing, this system helps in the timely delivery of goods. Reduced processing requirements and increasing automation enable firms to focus on other strategic functions.

Exhibit 19.1 shows the Bolero Solution.

Exhibit 19.1: Bolero Solution

Bolero is a joint venture between the Society for Worldwide Interbank Financial Telecommunication (S.W.I.F.T), the industry-owned cooperative, supplying secure, standardized messaging services and interface software to 7,500 financial institutions worldwide, and the Through Transport Club (TT lub), representing the world logistics and transport industry. Bolero facilitates online sharing of key trade documents, between the trading partners. The trading partners include importers, exporters, financial institutions, and logistics partners. Bolero acts as an intermediary and enables secure electronic delivery of trade documents and receipts between different parties. Bolero also has a legal structure (rule book), which needs to be followed by the clients. This legal structure is based on certain common laws that exist in different countries. If any disputes arise between the trading partners, they need to be resolved, within this legal structure. This system enables trade documents such as purchase orders, commercial invoices, freight invoices, bills of lading, advanced shipping notices, and air waybills, to be processed within 2 days, instead of 10-15 days, in the normal course. This also enhances transparency in the supply chain, as information about trade transactions can be traced easily. Bolero has developed the solution, on an open platform so that the firms can develop their own systems and integrate them with Bolero’s solution.

Source: ICFAI Research Center

19.4.3 Credit Information and Management Systems

Credit appraisal and analysis of customers is vital to any B2B firm. Evaluating and monitoring the credit history of a customer is important, in taking decisions about extending or continuing the credit to its customers. Providing credit, without a proper assessment of creditworthiness, can lead to an increase in bad debts. A reliable and fast credit information and management system can help the firm, in making credit decisions faster. This can increase customer satisfaction and at the same time, with a proper assessment of customer credit history, the credit risk can also be reduced. Following are some of the ways, through which these systems can help.

Assigning ratings to the customers. By providing the required credit rules to these systems, a firm can obtain the ratings of its customers, as per the predefined credit rules. This would help the firm to distinguish between the customers, who need to be focused upon and the customers, who need to be ignored.

Helps sales representatives during the sales process. By entering the customer data into these systems, they provide instant credit analysis information, about the customers, such as credit limit and credit terms. This helps sales representatives, in taking faster decisions at the point of sale, to sell higher range products to the customers, to provide liberal credit terms to the customers, with high credit limits and good credit history. Sales representatives can also decide upon the pricing of the product, based on the credit risk. A firm can charge a higher price to customers with high credit risk and a lower price to customers with low credit risk. This helps the firm in improving its revenue and in reducing its credit risks.

Improved customer satisfaction. Faster credit processing enables the firm to process orders without much delay, thus, increasing customer satisfaction. This may help in developing a long-term relationship, with the customers.

With the emergence of the Internet, the firms have begun to provide these services, on the worldwide web.

Example: IT Platform for SMEs in Financial flow

Heering-Holland's, with global operations, located at Vaassen in the Netherlands, had the product portfolio of trucks and vans for conditioned poultry transportation. The significance of IT platforms was that they facilitated information, communication and new technologies, allowing companies to improve efficiency and optimise their supply chain processes. Heering-Holland collaborated with TradeCloud.

Contd….

TradeCloud IT was an IT platform providing supply chain services like: Zero touch handling, Real time insight and Communication in contexts; i.e. providing same information for all affected parties during possible disputes. TradeCloud IT platform connected companies' ERP systems and helped order handling and delivery processes, impacted goods flows information, influenced working capital, and also Cash-to-cash cycle.

TradeCloud IT, a multi-sided platform was used in supply chains to automate Purchases-to-Pay and Order-to-Cash processes. Other advantages included reduction of manufacturing lead time and delivery time, reduction of errors and integration of supply chain.

The use of IT platforms, like TradeCloud IT, could automate business processes, aid in the continuous improvements of supply chain, operational networking, and capital management. Thus, IT platforms increased the efficiency and agility of business processes. Financial advantages covered: order processing costs reduction, lower inventory costs, better Accounts payable and Accounts receivable accuracy, and shorter Cash-to-Cash Cycle.

Source: https://www.researchgate.net/publication/356810323_CASE_STUDY_SUPPLY_CHAIN_FINANCE_IT_PLATFORM_FOR_SMEs March 2022, Accessed on 1st October, 2022

19.5 Integrating Material and Financial Flows in a Supply Chain

Firms in the past have mainly focused on improving the material flow in a supply chain, using various innovative methods like cross-docking, vendor managed inventory (VMI), collaborative planning, forecasting, and replenishment (CPFR), etc. Firms have also used IT solutions to automate material flow. Today, they have also begun to focus on improving financial flow in the supply chain. Many firms have adopted best practices of cash flow management, to improve the financial flow. Many firms have automated the same or all of the elements of the financial flow in a supply chain, through implementing ERP systems and cash flow management solutions. However, most firms have not focused much on integrating the material and the financial flow, in a supply chain. By integrating material and financial flows, firms can remove the inefficiencies, in the supply chain. Integration of these two flows can be done, in three different ways.

Linking of functional systems with financial systems. For example, by linking the procurement system with the accounts payable system or the ERP system, the physical order information can be matched with the financial information, thus reducing the errors, arising due to improper information flow between the two systems. This linking can also be extended to the supply chain partners, thus, enabling the physical order information flow, to closely match with the payment information flow. This enables increased collaboration between supply chain partners.

Linking supply chain partner's or customer's preferences and behavior with the financial elements. Firms can track and analyze the behavior of supply chain partners and customers. Based on the needs and requirements, firms can provide financial options to the customers and supply chain partners. Suppose, a firm orders a large consignment from a supplier**,** then the firm can provide the option of paying the amount through traditional means like checks or through electronic means. The supplier can decide upon the payment option. If the supplier wants a faster payment, he may opt for the electronic payment.

Linking financial and physical flows based on business intelligence. Firms can set the pricing of the product and payment options based on the customer's requirements and the existing market conditions. This may help the firm in maximizing its revenue. This policy is well utilized by airline companies, where flight ticket prices are changed depending on supply and demand conditions.

To align financial and physical supply chains, firms need to reengineer the physical flow processes, to integrate them with the financial processes. Automation of financial processes is an area, where the firms have to focus. Integrating financial flow with the material flow provides many benefits to the members of the supply chain. Members can obtain the products, as per their requirement and pay the supplier using a suitable payment mode. With such integration, members share a common and full view of all their transactions, thereby increasing efficiency in the supply chain. Specific benefits for the members of the supply chain are:

- Suppliers can make accurate forecasts about working capital requirements and also product demand. Thus, inventory levels and working capital can be reduced, as they have a better view of the situation. They can resolve disputes easily, as both the supplier and the customer share the same information, about the transaction. Payment processing can become faster. The processing costs due to personnel and paperwork are reduced. Errors are minimized, thus helping the supplier to obtain correct payment.
- Buyers can benefit from perfect order delivery. This helps the buyer to forecast and plan effectively. Thus, the buyer can reduce working capital requirements to deal with the payables. With the automation of the processes, buyers can reduce the time and costs in processing the invoices like routing for approval, and matching the invoices and payments.
- Trade terms can be negotiated more effectively between the buyer and the supplier because of the availability of precise information about a transaction. Buyers and suppliers have an accurate view of the risk involved. Hence, the buyer and the seller can negotiate financing options like insurance, supplier credit, etc., more optimally.

Example: Value Stream mapping at an Amazon ecommerce Retailer

Amazon had the best selling products such as, phone cases, and party decorations. The orders were placed weekly, and the inventory was stored at office in Shenzhen, China, to further ship to their customers. To be competitive in this area, e-retailer was aiming at improved supply chain operations, reduction in costs, and enhanced customer satisfaction.

Value Stream Mapping (VSM) was a tool built by lean production movement helping in reduction of errors, allied losses, and lead time from improvement of value-added activities. Value Stream Mapping (VSM) could be used to methodically measure, evaluate, and integrate all of the activities in production processes. This would help achieve a competitive advantage by reduction of errors and losses, and lead-time.

VSM was mapped on the supply chain process of the e-retailer for analysis. The production process activities were classified as: Value-Added (VA), Necessary but Non-Value-Added (NNVA), and Non-Value-Added and unnecessary (NVA). The focus of VSM was to reduce NNVA activities, remove NVA activities systematically, and ensure efficient flow of products, information and funds, helping value-creating time.

Source: https://www.researchgate.net/publication/357744825_Application_of_Value_Stream_Mapping_in_E-Commerce_A_Case_Study_on_an_Amazon_Retailer January 2022, [Accessed on September 15, 2022]

Activity 19.2

Information Technology revolutionized the management of financial flow in a supply chain.

- What are the IT solutions used for automating financial flows in a supply chain?
- Explain the ways of integrating material and financial flows in a supply chain.

Answer:

Check Your Progress - 2

6. In the consolidator model for the implementation of Electronic Invoice Presentment and Payment system, who manages the application?
   a. Supplier
   b. Buyer

c. Customer
d. Partner
e. Third-Party

7. Which of the following is not a major part of integrating material and financial flows in a supply chain?
   a. Linking of functional systems with financial systems
   b. Linking supply chain partners or customer's preferences and behaviors with financial elements
   c. Financial and physical flows based on business intelligence
   d. Linking material flows with supply chains
   e. Linking material flows, with HR policies
8. Which of the following is not a major use of credit information and management systems?
   a. Assigning Ratings to the customers
   b. Helping Sales Representatives during sales process
   c. Improving customer satisfaction
   d. Forging long-term relationships with customers
   e. Handling Non-Performing Assets (NPAs)
9. Which are the two popular solutions available in the market, for Electronic Trade Financing Systems?
   a. Bolero and trade card
   b. Globe and city
   c. Jaguar and land rover
   d. Innova and trade
   e. Impala and trade
10. Which, of the following, is not an important step to expedite the order to cash process?
   a. Review of processes and procedures
   b. Identifying the processes fit for automation
   c. Developing appropriate performance metrics
   d. Designing an effective reporting system
   e. Developing software for implementation

19.6 Summary

- Financial flow is an important flow in any supply chain.
- Streamlining the financial flow can provide the firm opportunities to increase the efficiency of the supply chain, and improve its profitability.

- In this unit, we examined the two key components of financial flow in a supply chain: the purchase-to-pay process and the order-to-cash process.
- The purchase-to-pay process consists of financial transactions with the suppliers and the order-to-cash process consists of financial transactions with the customers.
- We also discussed the automation of financial flow in a supply chain. There are many IT solutions that can be used to streamline the financial flow in any supply chain. Prominent among them are the EIPP solutions, electronic trade financing systems and credit information and management systems.
- Finally, we discussed the ways to integrate physical and financial flows in a supply chain.

19.7 Glossary

CPFE: Collaborative Planning, Forecasting and Replenishment. It is a materials management system, in which the manufacturer and the supplier jointly plan, forecast, and ensure timely replenishment of stocks, to ensure smooth supply chain processes.

EIPP: Electronic Invoice Presentment and Payment. EIPP solutions enable the supply chain partners, to send or receive invoices and make payments electronically.

ERS: Evaluated Receipt settlement. It is a payment settlement system, in which the firm pays the supplier for what it receives, without the need for an invoice.

Order-to-cash process: It is a process of financial flow in a supply chain, which consists of financial transactions, with customers.

PTP: Purchase-to-pay process. This component of financial flow in a supply chain consists of all financial transactions, with suppliers.

VMI: Vendor Managed Inventory. It is an inventory management practice, in which a supplier of goods, usually the manufacturer, is responsible for optimizing the inventory, held by a distributor.

19.8 Self-Assessment Test

1. Describe the Components of Financial Flow in a Supply Chain.
2. What is the Process of Automating Financial Flow in a Supply Chain?
3. Elaborate on the Process of Integrating Material and Financial Flow in a Supply Chain.

19.9 Suggested Reading / Reference Material

1. Ashley McDonough, Operations and Supply Chain Management Essentials You Always Wanted to Know: 15 (Self Learning Management Series) Paperback – 1 January 2020.

2. Russel and Taylor, Operations and Supply Chain Management, 10 ed, ISV Paperback – October 2019.

3. Chopra and Kalra, Supply Chain Management 6/e Paperback – 17 June 2016.

19.10 Answers to Check Your Progress Questions

1. (c) Inspect

It is not a stage, in the purchase-to-pay process.

2. (e) There is no guarantee that the customer gets what he wants

It is not an advantage of the Evaluated Receipt Settlement (ERS) system.

3. (d) Avoids disputes

It is the most important advantage of the Electronic Invoice Presentation and Process system.

4. (c) Direct cash and carry

It is not a way to improve the process of the payment system.

5. (b) Reject if the customer is new

It is not a defined stage in the order-to-cash process.

6. (e) Third-party

Third-Party manages the application in the consolidator model, for implementation of Electronic Invoice Presentation and Payment system.

7. (e) Linking material flows with HR policies

It is not a major part of Integrating Material and Financial Flows in a supply chain.

8. (e) Handling Non-performing assets

It is not a major use of the Credit Information and Management System.

9. (a) Bolero and Trade Card

These are the two popular solutions available in the market, for Electronic Trade Financial Systems.

10. (e) Developing software for implementation

It is not an important step, to expedite the order-to-cash process.

Unit 20

Emerging Trends in Supply Chain Management

Structure

"Computers are able to see, hear and learn. Welcome to the future."

- Dave Waters

20.1 Introduction

The emerging supply chain technologies as well extensive research in Information and Communication technology, will definitely shape the future of supply chain. These emerging technologies are: AI, IoT, Big Data, Augmented Reality, Block Chain, Drones, Deep Learning, Metaverse, Green SCM, e-SCM and Machine Learning.

In the previous unit, we discussed the components of a financial flow and the way they can be improved. Then, we examined the various options available for automating the financial flow in a supply chain. Finally, we discussed the ways by which the integration of material and financial flows can be achieved.

Increasing competition in today's global markets, reducing customer loyalty, shorter product life cycles, optimal cost of production and delivery, changing modes of communication, rapid development in technology and changing customer attitudes have thrown a variety of challenges, to the way the supply chain of an organization is managed. Organizations have realized that it is just not enough to manage the supply chain efficiently and effectively, but it is also equally important to plan the strategies and practices related to it. Supply chain management (SCM) is going to play a much bigger role, in the next decade, than what it did during the last decade. Organizations have to gear up themselves, redesign their strategies, and get ready to understand and react to aspects like flexibility, adaptability, volatility, and agility, to get better outcomes from SCM.

This unit focuses on the trends and issues, which are going to dominate the future of supply chain management.

20.2 Objectives

By the end of this chapter, you should be able to:

- Explain the emerging aspects of supply chain
- Analyze various issues, involved in the supply chain in the future
- Evaluate possible strategies, to adapt to the changing trends in supply chain

20.3 Supply Chain Eco-system and Stakeholders in SCM

Supply Chain (SC) is fundamentally defined as a sequential conglomeration of value-additive processes/organizations, responsible for the assimilation of raw materials towards the production of a finished product, and the successful deliverance of the same to the end consumer/customer. The organizations therein purportedly place themselves such as to propagate a defined value to the materials/work-in-place product as the same flows through the chain, and are therefore responsible to subsequently perform the functions of any one or multiple of the following intermediaries: supplier, manufacturer, wholesaler, distributor, and/or retailer. The end customer defines the defined destination of the chain. Supply chain management (SCM) is described as the designing of the aforementioned sequence and thereby the procedures, guidelines, and performance metrics which would ensure improved productivity, enhanced positive value-propositions, and profitability for the cumulative and the individual players within the chain.

Broadly speaking, a supply chain is basically designed in accordance with the requirement/s of the primary player or intermediary within the chain. For example, in majority of the instances, manufacturer is generally considered as the major proponent of a supply chain, such as in cases of Proctor & Gamble, Zara, or Toyota. In other instances, the retailer could be one of the major designated exponent, in instances like Walmart, Amazon, etc.. Similar instances may also be cited for supplier firms as the primary intermediary spare-part manufacturing firms such as Sundaram Clayton. The relative positioning of the primary player within the chain defines two important aspects: the intermediaries within the supply chain scheduled for value-addition and responsible for deliverance to the primary player are constituents of *upstream supply chain*, whereas the organizations within the chain which receive value-added products from the primary player and thereafter engage in inducing additional value to facilitate conversion into finished products, represent *downstream supply chain*. Therefore, for Toyota, any supplier, parts-manufacturer, work-in-process material providers which assist in the successful completion of an automobile, are part of an upstream supply chain; whereas, the warehouses, exclusive retail showrooms, and franchised outlets of Toyota responsible for the actual sales, delivery, and subsequent after-sales deliverance of services to the customers, define the downstream supply chain for Toyota.

In instances where supply chains are required to be developed exclusively to capture the essence of the market and to enable smooth deliverance of products or services, 2 important parameters are required to be considered: the concept of *uncertainty*. Uncertainty is defined as the presence of vaguely identifiable randomness in the existing state of action/s, which reduces the reliability quotient of the state. In business situations, two such uncertainties exist: demand and supply. *Demand uncertainty* denotes the presence of volatility in the identification and understanding of the demand parameter within a single or multiple market settings at consecutive periods; whereas, *supply uncertainty* is described as the level of volatility prevalent amongst the suppliers or producers or manufacturers of the product or service offerings.

The other important parameter to be considered is the type of product being dealt with: functional or innovative. *Functional* products (Demand uncertainty: Low) characterize in their operability parameter, and are being frequented for their minimum functionalities, such as food grains, commodities, daily used apparels. *Innovative* products (Demand uncertainty: High) reflect the level of sporadic, systematic, or disruptive changes induced in the product through rigorous functional, physical, or application-based innovations, such as in cases of electronic products, and fashion apparels.

Hau Lee (2002) defined a matrix known as The Uncertainty Framework combining the aforementioned parameters: uncertainty, and type of products; and, thereby proposed distinct development of 4 different supply chains, each with specifically defined characteristics and importance, to differentiate and cater to the requirements of each of the combinations:

- Functional Products/Supply Uncertainty (Low): Efficient supply chain (Ex: oil and gas, grocery, daily used apparel)
- Innovative Products/Supply Uncertainty (Low): Responsive supply chain (Ex: fashion-based clothing)
- Functional Products/Supply Uncertainty (High): Risk-hedging supply chain (Ex: nature-based power supply such as hydro-electricity)
- Innovative Products/Supply Uncertainty (High): Agile supply chain (Ex: semi-conductor devices, super-computers)

The concept of SCM, its scope, strategies, and execution techniques have constantly been changing. Many new aspects have been added to this concept, through professional and systematic research studies conducted worldwide. Its significance and utility were originally thought to be only for the manufacturing sector, but research proved that successful implementation of SCM brought highly effective results in all sectors, including the service sector.

In India too, the implementation of SCM has gained a lot of importance, during the last couple of years and many companies like TVS, Hero Motors, MRF, TATA Motors, and Mahindra & Mahindra have obtained benefits like overall cost reduction, optimum utilization of resources, and competitive advantage through it. Due to the increasing complexities of business, with the impact of factors like globalization, changing customer demands, rapidly developing technology, changing communication trends, etc., the future of SCM is going to be much more complex and dynamic.

Traditional SCM, with an objective of improvement in the overall supply chain profit (SCP) by mutual coordination, cooperation, trust, integration, and information sharing, will have to move further and become more agile and dynamic, for the sustainability of existing supply chains. Future market dynamics are going to be continuously challenged, by issues like flexibility, speed of delivery, increasing product variety, high product quality, and low price.

Factors Influencing the Trends in Supply Chain Management

Factors, which influence and contribute to the emerging trends in SCM, as per various studies conducted worldwide, are as under:

- Delivery speed and globalization
- Shorter product life cycle
- Changing demands and aspirations of customers

- Product variety
- Conflicting objectives of stakeholders
- Service chains
- Fluctuations in demand
- Economic volatility
- Higher responsiveness parameters
- Economies of Scale versus Economies of Scope

Delivery Speed and Globalization:

Quick delivery of products and services is the order of the day. The speed at which companies are delivering the products and services has been increasing day by day due to competition, globalization and customer demands. Quick delivery requires very efficient and effective planning and execution of all strategies at all levels of supply chain.

- The speed of delivery to the customer increases only when all the internal processes related to supply chain is well managed and consume less time.
- Due to globalization, companies have multiple presences in different geographical areas of the world to take cost advantages. For example, computer manufacturer like Dell has its suppliers located around the world, manufacturing facilities located in USA, China and India, contract manufacturers located in China, packing and distribution facilities located in USA and India, and customers located across the world. In spite of this, it maintains the promised delivery speed and provides uniform service levels to the customers. This trend is going to become more complex in future.

Shorter Product Life Cycle:

Due to the spurt in new technologies, increasing competition and fast changing market dynamics, companies are forced to release new products and new brands very frequently. Fast changing human needs and reducing loyalty towards the same brand and product is also contributing towards reduction of span of product life. This emerging trend will increase further and complicate the supply chain strategies of companies as companies take longer time to achieve economies of scale or sometimes, it may be very difficult to achieve it also. This problem is now being faced by mobile phone manufacturers.

Changing Demands and Aspirations of Customers

Today, the customer is expecting everything to be delivered at the doorsteps. Customers have become more price sensitive and service conscious.

- Online product delivery companies have successfully created such delivery mechanisms where customer is able to select the products online at a

comparatively lower price and is able to receive them at the doorsteps within a very short span of time, for example, 24 hours to 36 hours and able to avail the high levels of service. These portals have redefined the way business operates.

- Challenges faced by these companies are to offer the product at a highly competitive price, provide online availability of variety and volume without stock- outs, pack and deliver as quickly as possible without any defective pieces and provide tracking facility to customers to know whereabouts of the products ordered.

Product Variety:

As the customers are more aware and knowledgeable these days, they demand more variety. This increases the number of customer segments and in turn, the organizations are forced to cater to large segments with more variety. This results in an increase in the cost of operations, supply-demand mismatch and requires frequent change of strategies. Therefore, production of variety products and managing their supply chains would be a challenge for the future. The supply chain models in the above businesses are designed to be highly responsive as well as efficient. This trend of changing customer demands, needs and aspirations is going to be much more complex in the future.

Conflicting Objectives of Stakeholders:

Supply chain consists of different stakeholders' right from the supplier to the end consumer.

- Each of these stakeholders has their *own objectives* of managing the business, at the same time, *mutually cooperating and coordinating* with the other members of the chain.
- Management of these conflicting objectives requires high mutual trust, information sharing, negotiation, sustaining relationships and creation of win-win situations among all stakeholders in the chain.
- Supply chain activities like transportation, sourcing, procurement, product design, storage, warehouse management, packing and distribution and delivery involve different stakeholders performing different actions with a *common objective of increasing overall supply chain profit than the individual profit*.

As there is no single individual responsible for this to happen, it poses a great challenge. With the increasing number of stakeholders in future, this trend will affect supply chain to a greater extent.

Increasing Importance of Service Chains:

Product design and product quality were most important aspects for customers till recently. Today, in addition to those, customer also wants very high quality

service to be delivered. This requires the service chain of the companies to be a differentiating factor for success in addition to the product chains.

For example, one can find little difference in the superior quality of products offered by companies like Sony, Samsung, LG, Canon etc. In such a scenario, service is the only strategy through which company can attract and retain the customer.

Higher Responsiveness Parameters:

With globalization as an important and highly prioritized aspect in designing of supply chains presently, and with shorter product life cycles, parameters related to responsiveness have carved out to be the major requirement of the day. Availability of wide assortment of products have induced the orientation towards development of products within a shorter lead time and shelving the same within a minimum span. Coping with changes in demand with the probability of minimum stock out and maximum product availability across majority of the market spaces tends to ensure smooth flow of the products to the customers thereby accruing the value-proposition for the manufacturing/service organization.

Economies of Scale versus Economies of Scope:

In the initial stages of the Industrial Revolution after World War II, the focus of the few developing manufacturing firms at that time, was oriented towards mass production of the products in advance, and then pushing the same into the markets through varied promotional techniques. For example, Ford Motors was one of the primary car manufacturing giants as part of Big-4 in USA at the time, and due to limited competition they could utilize their assembly-line style manufacturing procedure to mass produce their T-Model cars at a low cost and then induce aggressive and innovative advertising mechanisms to ensure higher sales. However, with the introduction of Asian car manufacturers into the USA markets in the later half of the 20^{th} century, competition increased and focus shifted towards the development of a wide assortment of car-variants, primarily targeted towards multiple different customer segments, rather than stick with just a single product category. As such, the focus shifted towards producing different varieties of car models, using the same platform as much as possible, low in number, and most importantly based on the real-time assessment of actual demand. Therefore, the initial strategic alignment towards using economies of scale as an important attribute in higher sales generation and probability, gradually permeated towards the use of economies of scope for better reach and higher demand satisfaction.

20.3.1 Stakeholders in Supply Chain Management (SCM)

Supply Chain Management is the most involved activity, in operations management. Therefore, it has many stakeholders in its operational performance

and success. Obviously, they influence and affect it, in many ways. The prominent stakeholders are those, who are the actors in various stages of the total supply chain. They include the management team and other internal employees, external agencies like customers, developers, contractors and suppliers, partners and collaborators, regulatory agencies, financial institutions, to name a few. Among all, suppliers need a special mention, as modern supply chains are vendor-intensive. Only core activities are kept within the organization and all other activities are outsourced. Growing environmental concerns brought in the role of regulatory agencies, to ensure that the SCM is complying with the applicable regulatory framework. Customers constitute other significant stakeholders, as they favor the organization with their orders and repose confidence in the organization, to supply high-quality products and services, as per mutually agreed terms and conditions.

Example: Stakeholder Management in the Sustainable Supply Chain of Bioenergy Industry

Stakeholder engagement, managing and satisfying their requirements, aiming for a Sustainable Supply Chain Management (SSCM) at bioenergy (pulp, paper, and wood industry) industry in Chile was analysed. Two aspects were studied: "practices to address stakeholder requirements" and "practices whereby stakeholders are integrated."

The analysis stressed the fact, that maintaining transparent, constant two-way communication with stakeholders using multiple platforms or social media channels were the practices leading to results. Organizing stakeholder workshops, maintaining personal dialogue with their representatives, making field visits, and policy of open doors were also essential, to promote interaction, to learn about needs of the community, and record their concerns. These two-way communication with stakeholders, gave opportunity to resolve the raising concerns via technical or organizational transformation at the internal supply chain level.

Transparency through one-way communication was adopted to update to opted stakeholders on business activities, reports etc. Linkage development with local stakeholders, aiming at improvement of the community's well-being, had positively contributed to social Supply chain performance. Proper application of Supply chain external practices, integrating stake holders, linkage development, educating stakeholders, increased authenticity for business. Involving and integrating with stakeholders, could erase resource, knowledge gaps and deficits, go beyond boundaries to tackle SC issues, beyond its own boundaries.

Source: https://onlinelibrary.wiley.com/doi/full/10.1002/bse.2792 May 2021, Accessed on 21/09/22

20.4 Future Trends in SCM

Supply chains need to evolve to survive. New technology, like robotic process automation (RPA), cloud computing and artificial intelligence (AI), replaces weak links and alters the supply chain software market at large. The following are the major trends in supply chain management:[1]

- Increased use of technology and digitisation: Cloud technology has received a tremendous boost during the pandemic, and it is estimated that the industry will be worth $1250 billion by 2028. Increased digitisation enables an end-to-end overview of the supply chain, which apart from building transparency, helps in forecasting disruptions. This enables stakeholders with quicker decision-making based on real-time insights.
- Increase in tech-enabled procurement: With Covid-related travel restrictions imposed, travelling to the source as a standard procurement process was halted, and thereby reliance on tech-enabled sourcing was increased. Remote sourcing is estimated to become more dominant with technologies, such as Augmented or Virtual Reality, AI and Blockchain.
- The growing share of small-sized retailers: Smaller-sized retailers will exert more control over the global retail sector due to the shift in power of the global retail industry in favour of third-party e-commerce platforms. SME retailers will emerge as a dominant sector and this will lead to global sourcing shifting from traditional, in-house sourcing experts to independent or freelance sourcing experts, who will work with multiple buyers for shared procurement resources.
- Drone deliveries: India's Drone Rules 2021 will pave the way for faster deliveries, smoother logistics and substantial reduction in carbon emission. Drones facilitate last-mile deliveries and are becoming a trend in congested, urban areas.
- Climate-smart supply chain planning: Ninety per cent of millennials are estimated to pay more for products that have been produced in a sustainable manner. Thus, in an effort to be more environmentally responsible, companies will be increasingly adopting decarbonisation strategies and pushing for greener business solutions. Greener transportation methods are rising, with the global electric truck market projected to reach $1,893.1 million by 2027. Electric two-wheelers, three-wheelers and light commercial vehicles are becoming popular as companies replace their existing ones with greener vehicles. From building smarter warehouses with energy-efficient systems to creating greener cold supply chains and solar-powered, temperature-controlled units, the logistics and supply chain sector will integrate smart and planet-friendly systems in their operations.

[1] https://economictimes.indiatimes.com/small-biz/sme-sector/top-5-trends-in-supply-chain-management-to-look-out-for-in-2022/articleshow/89679209.cms, February 19, 2022 (accessed on December 15, 2022)

The above trends will play a critical role in building a more resilient logistics infrastructure, proactively address supply chain challenges and meet new customer demands.

Example: AI Logistics Warehouses at Amazon

Amazon had achieved top rankings in the path to future trends usage of technology in web services, logistics and warehousing. They utilized AI and machine learning to warehouse operations. They streamlined the processes for use, automation, by implementing complex future technologies at fulfillment centers, and achieved reliable one-day shipping. From the 1-4 million product bins in each Amazon Fulfillment Center, they used computer vision systems, to examine images for tracking item's position inside the warehouse and store them into right specific pods at the initial stages.

AI was used to automate customer data forecasting, check the product availability, choose optimal delivery routes, and had more personalized communication in the active supply chain. Machine learning, and optimization algorithms improved the existing processes for smooth one-day shipping. AI-powered robots helped carrying of the products, and algorithms helped them to learn in real-time where the order was, where it should be, and how to get there the fastest viable way. Small, Roomba-shaped robots ("drives"), followed defined paths to deliver huge volumes of products to co-human workers. Fulfillment center automation was utilizing various technologies, like: autonomous mobile robots, complex control software, language interpretation, computerized vision with depth sensing, recognizing objects, and semantic decipher of comments, leading to 40% more inventory storage.

Source: https://tbtech.co/featured-news/amazons-ai-logistics-warehouses/December 2021, Accessed on 21/09/22

Activity 20.1

The global competitive environment is expecting dramatic changes, in the area of SCM. Some significant studies have been conducted, by renowned organizations, on future trends, in the area of SCM.

Identify the most significant common findings, among all the studies narrated in this unit as applicable to the Indian service industry, with justification for the choice you made.

Check Your Progress - 1

1. Traditional supply chain management, with an objective of improvement in the overall Supply Chain Profit (SCP) by mutual coordination, cooperation, trust, integration, and information sharing, will have to move further. Which of the following should be focused on for the sustainability of supply chains?
   a. Agile and dynamic
   b. Passive and creative
   c. Interesting and economic
   d. Prompt and confident
   e. Agile and frugal
2. Which of the following is not a factor found to influence the future trends in SCM, as per the studies conducted worldwide?
   a. Delivery speed and globalization
   b. Shorter product life cycle
   c. Changing demands and aspirations of customers
   d. Product volume
   e. Product quality
3. Which is the problem faced by mobile phone manufacturers like Apple, Samsung, Micromax, etc.?
   a. Longer product life cycle
   b. Short product life cycle
   c. Long technology life cycle
   d. Short technology life cycle
   e. Uncertain delivery life cycle
4. Which of the following does the management of conflicting objectives require?
   a. Mutual trust and win-win
   b. Individual trust and win-lose
   c. Equal trust and win-win
   d. Mutual profit and win-win
   e. Compromises and friendly

20.5 Operations Technologies and Green Supply Chain Management (GSCM)

While many new operations technologies are expected to invade the modern shop floor, all of them will have to address one very important common issue-

eco-friendly supply chains, with a focus on resource conservation, waste minimization and, low carbon footprint, through effective emission control. For a supply chain to be green, it is essential that all the members of supply chain should adopt green measures.

For example, MNCs like Walmart, P&G, Intel, IBM, and Dell announced that they would reduce their emission levels, in the supply chain, significantly in the future.

"Business leadership is no longer limited to financial performance, but includes assuming responsibility. This responsibility extends to understanding environmental impacts and encouraging improvements, within Intel's supply chain. Doing so will help us manage risk, lower environmental impacts and costs, and bring greater transparency."

Todd Brady, Corporate Environmental Manager, Intel

"Dell partners with suppliers, customers, and stakeholders to drive sustainable operations, throughout our business. Ensuring sustainability in our global supply chain is an integral part of our commitment to environmental stewardship."

—Mark Newton, Director of Sustainable Business, Dell

Unilever's focus on sustainable sourcing[2]

Unilever's raw materials and packaging account for more than 60% of its direct value chain emissions, necessitating a firm emphasis on efforts to reduce emissions upstream of its operations.

Across its Home Care business, Unilever's 1 billion Euro Clean Future strategy is to replace fossil-fuel derived carbon with renewable or recycled carbon in all its cleaning and laundry product formulations by 2030 – a move expected to reduce product emissions by up to 20%. This includes using sources of carbon already on or above ground, instead of extracting fossil fuel from underground sources. For example, in China, its OMO brand has partnered with leading technology and chemical manufacturing firms to develop a new surfactant for its laundry capsules made with captured emissions.

Unilever plans to work with 300 suppliers to help them measure, report and reduce their emissions. Unilever has also been taking action through nature-based solutions that help to reduce emissions and protect and regenerate nature. The company is committed to achieving a deforestation-free supply chain, by the end of 2023, across palm oil, soy, paper and board, tea and cocoa. Its collaborations with technology partners and use of satellite imaging, AI, blockchain, and geolocation data improve transparency and traceability, enabling it to identify and

[2] https://www.weforum.org/agenda/2022/11/scope3-supply-chain-emissions-cop27-ikea-philips-zf-unilever/ (accessed on December 15, 2022)

act on deforestation risk more quickly. At the same time, the company is working to empower smallholder farmers to use regenerative agricultural practices that improve soil quality and increase yields.

Unilever is also asking its suppliers to lower their own emissions in line with climate science. The company buys products and services from around 54,000 suppliers and so identified a subset of suppliers whose materials have the highest impact on the climate. Through the 'Unilever Climate Programme', the company plans to work closely with 300 suppliers and offer hands-on guidance and access to tools and resources to help them measure, report and reduce their emissions.

In 2021, Unilever engaged a small, diverse group of suppliers to help shape the program, catering for the noticeable range in capacity and capabilities among the wider target group. After this, the company ran a pilot in 2022 with a slightly larger group to test out a set of interventions. Unilever is now incorporating supplier feedback as it prepares to roll out the program to the remaining target suppliers from 2023.

The company also developed the 'Unilever Climate Promise' which asks suppliers to set a target to halve their greenhouse gas emissions by 2030, publicly report progress, and share the GHG footprint data for the materials they supply to Unilever. While voluntary, Unilever has communicated that it is prioritizing partnerships who demonstrate shared values and a vision of a sustainable future.

Unilever does not only collaborate with its own suppliers. It is a member of the 1.5-degree Supply Chain Leaders Exponential Roadmap Initiative and the Transform to Net Zero Initiative where it collaborates with other businesses in similar and different industries to share learnings and ideas for accelerating climate action in value chains.

Downstream, Unilever has been working with transport partners to test out battery-operated refrigeration systems in its trailers, and with customers to pilot warmer ice cream cabinets coupled with innovative new ice cream formulations.

ZF supplies systems for the automotive industry and has been working to reduce its carbon footprint.

Since ZF directly and indirectly processes around 1.5 million tons of steel per year worldwide, one key lever to achieve this is the purchase of sustainable sourced material.

The company is doing this by collaborating with its suppliers. ZF recently concluded a long-term supply agreement with H2 Green Steel - from 2025 through 2032 the company will ramp up and supply ZF with 250,000 tons of steel annually from a plant in Northern Sweden. This plant has end-to-end digitization, electricity from renewable sources and uses green hydrogen instead of coal. Using green hydrogen instead of coal means that the chemical reaction that occurs during steel-making emits water as opposed to CO2.

Long-term agreements like this play a crucial role in helping develop markets for green products, such as green steel. The agreement with H2 Green Steel will supply ZF with approximately 10% of its current steel requirements, reducing the company's emissions by around 475,000 tons of CO2 per year.

20.5.1: Manufacturing Intelligence

Manufacturing intelligence is an effective tool for decision-making in operations management. It enables automatic data capture from the shop floor, which in turn

- Delivers real-time visibility
- Provides analytics on key performance indicators (KPIs), to optimize business performance and
- Facilitates a real-time collaborative enterprise (stretching to other business units, and to supply chain partners).

The shop floor is more intelligent today, such devices as remote sensors, RFID, real-time location systems (RTLS) and the like, often on wireless networks, have created ultra-sophisticated shop floor networks.

20.5.2: Flexible Manufacturing Systems

A flexible manufacturing system (FMS) is a manufacturing system, in which there is some amount of flexibility that allows the system to react in case of changes, whether predicted or unpredicted. There are two categories of flexibility- machine and routing flexibility

Most FMS consist of three main systems:

i. The work machines (which are often automated CNC machines, connected by a material handling system. to optimize parts flow)
ii. The central control computer (which controls material movements), and
iii. Machine flow

Advantages

The main advantage of an FMS is its high flexibility in managing manufacturing resources like time and effort, to manufacture a new product. The best application of an FMS is found in the production of small sets of products like those from mass production.

- Reduced manufacturing cost
- Lower cost per unit produced
- Greater labor productivity
- Greater machine efficiency
- Improved quality
- Increased system reliability

- Reduced parts inventories
- Adaptability to CAD/ CAM operations
- Shorter lead times

Disadvantages

- FMS is a highly complex system
- Requires highly skilled technicians
- Needs a high level of planning
- Demands high initial investments

20.5.3 Modern shop floor

Emerging operations technologies are largely affecting the manufacturing eco-system with a significant impact on the shape and size of the shop floors. The advent of such technologies like robotics, artificial intelligence (AI), internet of things (IoT), and radio frequency identification (RFID) have all greatly influenced supply chain management. They facilitated the adoption of flexible manufacturing systems and manufacturing intelligence. Superimposed on this changing landscape of supply chain management is the need to address climate change concerns such as emissions and wastage of resources. All these developments are forcing the reengineering of the modern shop floor. They insist on the following

- Simplifying supply chain implementation, by focusing upon real-time manufacturing intelligence to speed up implementation and drive down costs
- Satisfying the strategic requirements of management, the visibility requirements of the supply chain, and the tactical requirements of the shop floor
- Treating supply chain visibility as customer-supplier relationships and partner relationships

Real-time supplier intelligence

Supplier intelligence is equally important. Part of the promise of RFID has always been end-to-end visibility, which would supposedly benefit both the customer (for example, Wal-Mart or the department of Defense) and the vendor, with rich informatics.

Example: Green Supply Chain Management (GSCM) – Impact on Operational Efficiency

GSCM encompassed integration of various green components in the operational supply chains for more effective usage of energy, quantifiable reduction of natural resource usage, impact with minimum possible environmental pollution, and facilitate more recycle of waste.

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Thus it was bound, to lessen any adverse environmental impact at all stages of conception, purchase, manufacture, package, logistics, distribution, and recycling, to enhance productivity, reduction of logistics costs, and enhancement of efficiency.

Company X adopted core green initiatives, and added refuse better than recycling for reductions of cost in certain cases. Other areas which paid attention and implemented by Company X were 'green purchasing, reduction of toxic footprints, align with suppliers with their own environmental standards and achieve zero waste to landfill. They established facts that, GSCM improved economic performance through reduction of cost, implementing new green approaches.

Source: https://www.researchgate.net/publication/348034712_The_Impact_of_Green_ Supply_Chain_Management_on_Operational_Efficiency_A_Case_Study December 2020, Accessed on 20/09/22

20.6 Impact of Resources on SCM

Supply chain management is resource-intensive and any organization focusing on operations management deploys most of its resources in SCM. Moreover, resources are becoming scarce and demand is increasing, due to increasing industrialization. Thus, there arose a need to manage the supply chains more efficiently and ensure sustainable operations management. Resources management has a major impact on the profitability of the organization, in addition to the adverse impacts on the environment. Optimal utilization also calls for identifying alternative materials and processes and simplifying various activities, all along the supply chain. Two other resources of potential scarcity are power and water.

All resources call for a focus on cost implications, which influence competitive advantage. Thus, organizations implement such strategies as water neutrality, carbon neutrality, and utilization of alternative and renewable sources of energy like solar power. Then comes efficient supply chain management, through waste reduction covering doing right first time and every time, recycling waste materials, reusing materials, etc.

Another important resource in operations management is the human resource, which affects the competitiveness of a product or service and, thereby, the profitability of operations. After globalization started, low labor cost countries like China and India benefited, through outsourcing.

Loss of jobs in developed countries and the need to make organizations lean and mean, intensified use of high technology solutions in operations management. Thus, technologies like robotics, internet of things, artificial intelligence are invading shop floors, displacing manpower. However, it is argued that manpower

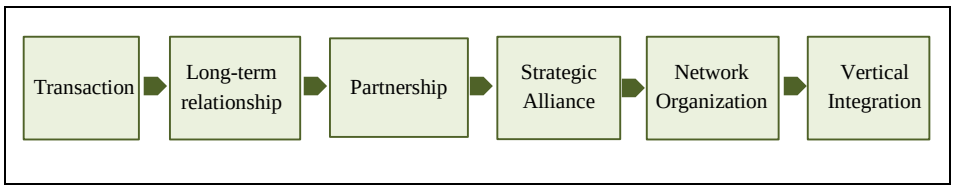
skilling is urgently required to meeting the emerging needs of these high technology solutions.

20.7 Vendor-Vendee Relationships and Partnerships

With the increase in competition to provide cost-effective, value-added products, efficiently in the global business scenario, SCM has become essential, while there is a growing trend towards developing strategic alliances and partnerships, to achieve a sustainable win-win situation for both vendor and vendee. A trust-based relationship, between different partners in the value chain, can create a synergy and show that they are interested in each other's welfare and, together, they are working for the end consumer's needs. A power-based relationship does not last long, since one party dictates, while a trust-based relation holds for a long time. Sharing details of sales and production information with vendors enables them to work out more cost-effective solutions for the vendee's needs. At the same time, the vendee works on building the vendor's capability and looking at the vendor, as a single point of sourcing. It can also mean saving of time and cost for vendee, by eliminating the inward goods inspection, since the process measurement and control charts are shared by the vendor, which creates a trust.

Trust building can be looked at in a deterrence-based view, where formal contracts are in place but parties behave trustworthily for their own benefit. The other perspective is a process-based view, where trust builds over a series of interactions. Any relationship can be built, by analyzing the value of the relationship, having clarity on roles & responsibilities, defining contractual agreements and designing effective conflict resolution mechanisms. A relationship with a 3PL can be reciprocal, while with a supplier it has to be long-term. Relationships can start as transactional and move to partnership and then to vertical integration. Figure 20.3 shows these relationships.

Figure 20.3: Relationships



Source: ICFAI Research Center

At the transaction stage, the focus is only on the cost and delivery, and there is no loyalty or relationship between vendor and vendee. This changes to price negotiations, and in partnerships trust is built, while in alliances focus is to achieve the strategic goals of the parties involved, while it is like a confederation in network organization and in vertical integration, they become part of the company.

20.8 Quality and Productivity Management in SCM

The importance of quality in supply chain management need not be overemphasized, as it is taken for granted that all products and services are of world-class quality they are:

- Globalization has brought global competition to the doorsteps of all types of organizations and encouraged them, to aim at attaining global standards in their operations.
- World-class quality ensures increased productivity at the least cost, as in such organizations, 'right first time and every time' will be the norm.
- Such an organizational culture ensures minimal rejections and waste, faster cycle times, and speedy delivery to customers.
- Global organizations and clients are insisting on such quality management standards, as ISO 9000, to demonstrate their commitment to operational excellence.
- It is established and acknowledged that efficient quality and productivity management, in supply chains, delight customers and build loyalty, paving way for sustainable operations.

Example: Quality Management at a Company in Vietnam

Businesses in Vietnam were adhering to Supply Chain Quality Management (SCQM), ISO 9000 certification to improve quality of their products/services. Company X was a *medium-sized* lighting product, electrical appliances, glass products, and vacuum flasks and materials, manufacturer in Vietnam. Within four years, company X implemented six different SCQM systems (KAIZEN, 5S, TPM, LEAN, Six Sigma, and Design Thinking). Initially, the company implemented Kaizen and 5S. Then it moved to implement QC and TPM (SCQM tools). The company was successful in cutting the poor maintenance costs. The company implemented TPM, to reduce production cost followed by total product cost. The company took the benefit of Pareto chart, to trace frequent default production unit and applied knowledge management system.

Source: https://www.tandfonline.com/doi/full/10.1080/13675567.2022.2059457 April 2022, Accessed on 19/09/22

20.9 Sustainability and SCM

Focus on quality and productivity is necessary but not a sufficient condition to ensure sustainable operations management. Sustainability encompasses not merely economic, but social and environmental dimensions also.

The economics dimension addresses the profitable supply chain operations, focusing on cost, quality, productivity, and optimal utilization of all resources.

This suggests the implementation of quality management standards like ISO 9000, as mentioned earlier.

The social dimension addresses the need to care for the community around the operations and the likely impact on their wellbeing. This includes the employees, their families and the general public as well. The issues involve ensuring safety, livelihood, and infrastructure development.

The environmental dimension includes eco-friendly supply chain operations, to keep emissions to a minimum and utilize scarce resources efficiently. This calls for effective implementation of environmental management system standards such as ISO 14000 and safety, health, and environmental (SHE) initiatives.

Occupational Safety and Health (OSH): From an SCM perspective, the OSH of the supplier chain and the contractor's chain needs to be considered. In the supplier chain perspective, the OSH could be regarding the safe use, handling of products, and exposure to certain hazards, in the global business scenario. There could be different types of issues, in terms of the contractor chain, as most processes are outsourced, by the company. Since some of these activities are done infrequently, the inspection or measures taken, to ensure safe practices, are very little. Some of these activities are done by contractors at the company site and if they are small players, there could be chances of illegal employment, unskilled/ unqualified personnel because of whom there is a higher risk. If these people are not trained or aware of the bio/ chemical/ radiation/ toxin or other exposure hazards, it can lead to a great problem. Host company should ensure that well-defined management practices, contracts, and code of conduct are in place, covering supplier and contractor chain also. Having declaration signed by the supplier for OSH compliance, inspection, monitoring, and training, are other ways to address this, for the supply chain.

Product-related safety and health requirements of suppliers, through a focus on sustainable products, are one way. The responsible care and product stewardship program, safety certification schemes, building the safety requirements into the selection of suppliers, are how these can be addressed. HER project empowers women working in global supply chains through workplace-based programs, capacity building of local civil society, and advocacy with business and government. In the European Union, a safety, health, and environment passport-SHE passport or a SHE card are issued to contractors, to certify they are aware and trained on the OSH aspects.

Example: Impact of Supply Chain Practices on Financial Performance

A sample of 45 Moroccan industrial companies, listed on the stock exchange and hailing from three different sectors were analysed to assess the Sustainable Supply Chain Relationships (SSCM) and impact on the financial performance of these companies.

Contd….

The three sectors were: automotive, pharmaceutical and biotechnology, and beverages industry. It was analysed through many statistical analytical approaches that, SSCM did not have a link to companies' liquidity, solvency, financial efficiency, but had a positive impact on profitability and market value, with variation of impacts among industries.

Source: https://www.researchgate.net/publication/358140198_2022_The_Impact_of_Sustainable_Upstream_Supply_Chain_Practices_on_Financial_Performance_Lessons_from_Moroccan_industrial_companies January 2022, Accessed on 17/09/22

20.10 Regulatory Framework for SCM

Another important aspect brought into the business environment is the need to comply with the regulatory requirements of the targeted markets. Even though safety-related regulations have been in vogue since long at the product level, system-level compliances came into being, with the advent of ISO 9000 quality management standards. This was followed by environmental management, occupational health and safety, information security, energy management, food safety, etc. At present, compliance with some of these standards and certification thereof is mandatory in some countries.

The episode of Volkswagen failing emission norms in the US resulted in an unprecedented penalty to the company. This is a gross violation in its supply chain, pushing a product that did not meet specified requirements.

Violation of food safety standards resulted in banning Maggi noodles in India for some time, as it was found that usage of certain materials exceeded specified limits. It was also attributed to the violation of food safety norms, in its supply chain.

Thus, regulatory regime has come to stay across the world and the increasing concern for the health of human beings as well as the environment is forcing organizations and their activities, to comply fully with the increasingly stringent norms.

20.11 Innovation in SCM

Increasing pressure on efficient resource management is encouraging organizations to look for strategic alternatives to combat competition and gain sustainable competitive advantage. Such strategies in trickles will not bring in, any break-through changes. Every activity, along the entire supply chain, will have to look for more efficient ways to conduct their respective operations, whether it is design, engineering, procurement, production, testing, packing, transportation, installation, or after-sales support.

To realize such ambitious goals, innovation is the only way.

When petrol became scarce and costly, many innovations happened, with a host of alternatives in fuels, vehicles, etc.

When climate change became a major global concern due to environmental degradation and depletion of resources, many innovative products and processes have been introduced. Eco-friendly supply chain management resulted in a number of initiatives around 'Green'- everything, from waste management to energy neutrality and water neutrality, is being focused. Coca-Cola came out with a pet bottle, which is made of sugarcane pulp. Most of the automobile manufacturers are focusing on electric cars and alternative fuels. They are also ensuring zero-landfills.

In this way, innovation is assuming increasing importance and encouragement, to foster more efficient and eco-friendly supply chains.

Example: Web3 and Metaverse Commerce at Flipkart's Innovation Lab

Flipkart developed innovation capability to build Web 3.0 solutions. Flipkart and its group companies could test Web3 and Metaverse use-cases, integrating with real-world applications: 'NFT-related, Virtual Immersive Storefronts, and Play to earn, and Block chain'. These could lead to future innovative research in the areas of, redefining customer experience, logistics / supply chain, and accelerating digital commerce. Flipkart had earlier innovations like: Cash On Delivery (CoD), Easy Returns, No Cost EMI, etc. Flipkart Camera with AR/VR features from Flipkart innovation labs, had built multiple 3D and Augmented Reality-based immersive shopping experiences.

Flipkart Labs were shifting from Web2.0 to Web3.0, and thus will have profound effect on e-commerce with applications built on 'decentralization, openness, and greater user utility'. They were looking forward to collaborate with Web3 community, and set the standard for use of Metaverse in commerce.

Source: https://www.dqindia.com/flipkart-to-explore-web3-and-metaverse-commerce-with-innovation-lab/ April 2022, Accessed on 17/09/22

20.12 HR Dynamics in SCM

The emerging landscape of supply chain management has posed many challenges, in operations management. They are related to all functional areas, right from understanding customer/ market requirements, product development, engineering, production planning and controlling, vendor development and outsourcing, quality management, production, testing, packing and delivery, installation, commissioning, and post-sale customer support. All these have one common aspect, namely the human element. Whether it is the manufacturer, supplier, or logistics provider, the human aspect became vital.

One major challenge, in emerging SCM, is human resources. Till now, the traditional staff in production and purchase departments rechristened themselves

as a supply chain e-procurement professional, without acquiring the necessary knowledge and skills. Since long, SCM is not a preferred area for work or for specialization in management schools. However, the pressure to be more efficient reoriented organizational attention, towards SCM. As activities of SCM are becoming more and more technology-intensive, talented and qualified professionals are required to man the functions of SCM. Shop floors are being modernized, with the large-scale replacement of traditional workforce of unskilled and semi-skilled manpower, with highly skilled technicians. This area continues to be a grey area, throughout the world and massive efforts are needed to reskill and reposition people in appropriate slots to ensure quality, productivity, and efficiency of operations. This approach extends to all other areas like quality management, logistics and customer service. It is the emerging scenario, where such initiatives like lean management, just-in-time, etc. play an important role.

HR dynamics needs to address the skill requirements, for managing SCM analytics. Visionary organizations are addressing this requirement with a new breed of scientists called data scientists. Data scientists look after the spectrum of data, the organizational needs for supply chain management, and the networking needs for decision-making. The specific areas in supply chain management are those, effectively addressing warehousing, transportation, and such areas of logistics. Another area of great significance in supply chain management is e-procurement, which calls for a new generation of HR professionals, skilled in information and communication technology, and online purchasing and payments.

Example: **People Orientation at Apple Supply Chain**

Apple's supply chain included millions of people. Their supply chains diligently obeyed and fulfilled the responsibilities towards them, while looking for more. Apple made a detailed human rights document, putting people first. Apple acknowledged the efforts of their strong partners, hard work, innovation, and resilience and teamwork from complete supply chain for their incredible technology being shared to the world. Apple believed that these efforts were possible with the strong partnership and teamwork from supply chain. Over a period, 21.5M supplier employees of Apple's supply chain were trained on workplace and human rights with new tools and Amazon continually improved quality of the training.

Apple came up with the 'Machine Design Safety Guide' of supply chain machine builders to help adhere to and drive high safety standards. Apple was deeply committed to supply chain people safety at work, and set highest labor standards, human rights, protection to environment, safety and health.

Contd.….

Apple extended educational programs to people living in communities where their suppliers source minerals, and support local communities through NGO Pact.

Apple worked from the initial stages of product design and ensured complete health and safety of supply chain team with regard to materials, machines, and processes, used in the manufacturing.

Apple's Supplier Employee Education and Development (SEED) program, had trained around 4.6 million supplier employees for skills building and advancement in the jobs. SEED program, with iMac-equipped classrooms, coding courses, and vocational certification programs, had evolved into higher education opportunities helping their supply chain team members for advancement in their careers.

Source: https://www.apple.com/supplier-responsibility/pdf/Apple_SR_2021_Progress_ Report.pdf Accessed on 19/09/22

20.13 Risk Management in SCM

Today, many enterprises spend most of their budget on purchased goods and services, because of the current trends of globalization, outsourcing, supply-based rationalization, just-in-time deliveries, lean inventories, and cost competitiveness. While global outsourcing offers benefits of efficiency and effectiveness, it can make supply chains more brittle and vulnerable, increasing the risk of supply chain disruptions. The Fukushima disaster and its impact on MNCs like Toyota is a classic example of highlighting the risks associated with SCM. A single event can severely damage an enterprise to any extent. This emphasizes the need for effective Supply Chain Risk Management (SCRM), as a precondition for a successful business.

SCRM focuses on the following steps:

- Identifying internal and external environments, to define the risk profile
- Risk identification and assessment, covering analysis and evaluation
- Identification of the various metrics and their effective quantification for optimality
- Identification of the alternatives for better risk hedging
- Risk treatment for mitigation and emergency preparedness
- Continual monitoring and review of risks and their treatment for effective control

Supply chain risk management council (SCRMC) defines 'supply-chain risk', as the likelihood and consequences of events at any point in the end-to-end supply chain, from sources of raw materials to end use of customers. SCRM integrates initiatives like business continuity and security.

A research, conducted by the chartered institute of purchasing and supply (CIPS), reported a reduction in global supply chain risk levels, falling to 78.1 (from 82.4 in the previous quarter). CIPS supply chain risk index (CRI) is an indicator of pressures acting upon supply chains globally and considers socio-economic, physical trade, and business continuity factors, contributing to supply chain risk across the world. At a time, when supply chains are longer, more integrated, complex, and global, the effects of events like sanctions on Russia and the crisis in the Middle East, for example, impact businesses around the world. The risk index shows that supply chains are being increasingly exposed to disruptions, corruption, and incompetence, highlighting the need for a far better understanding of supply chain risk management. It also demonstrates the need to understand the interrelated nature of economic, environmental, and social impacts, on supply chain activities, by business and government. Many events are still threatening and undermining the improvement in supply chain risk; if the Ebola outbreak in West Africa necessitates a tightening of international borders, the world will shrink, leaving storerooms empty and workers idle. Britain's horsemeat scandal and the Rana Plaza factory collapse in Bangladesh demonstrate that there are still major dangers, particularly over the lack of visibility, oversight, and control from businesses, of their suppliers.

The length and complexity of supply chains mean underlying issues remain unknown and are invisible to buyers. CIPS' research has uncovered that almost three quarters (72%) of British supply chain professionals have zero visibility of their supply chains, beyond the second tier, with only 11% saying they have visibility along the entire chain. This highlights a serious skills gap, as inadequately trained supply chain managers are either unaware of the risks or unable to mitigate them. It is important that CEOs and corporate boards understand their supply chains thoroughly. At times, when companies are operating across borders and are facing difficult decisions about their supply chains and with elevated levels of uncertainty surrounding economic, financial, and political risk factors, better knowledge and closer co-operation, between buyer and supplier will help increase understanding and provide safeguards that will limit the risk to trading. This will lead, ultimately, to the survival of business and organizations around the world.

Example: Develops Supply Chain Risk Management Capabilities

The company was a multinational food manufacturing company, having revenue greater than $10bn. It specialized on convenience food products across global 15 countries. The company embarked on identifying risks related to supply chain (commonly single supplier sourcing, supplier capacity constraints, supply quality issues, long lead times for alternatives development).

Contd……

One of their single-source ingredient suppliers did not meet the quality audit, and needed an alternative supplier approval process, affecting supply to the market. In addition to this, they also wanted to build mitigation strategies to ensure supply continuity. With the help of GEP's consultants experts, a customized supply risk assessment model was built, which factored nine unique parameters of risk and allied risk mitigation plans. These ideas helped the client recognize high-potential supply risks and building mechanism of mitigation, by collaborating cross-functional teams like R&D and Quality. The ideas also insulated company against unforeseen price risks, by suggesting development of alternative sources of supply.

Source: https://www.gep.com/case-studies/thank-you?sourcenid=5107&type=case_ study& source_pageurl=https%253A%252F%252Fwww.gep.com%252Fcase-studies%252Ffmcg-major-transforms-supply-chain-risk-management%253Fajax_ form%253D1%2526_wrapper_ format%253Ddrupal_ajax, 2022, *case study Accessed on 19/09/22*

20.14 Corporate Governance and Ethical Issues in SCM

In view of intense supply chain activities in organizations, with enormous resources deployed, top management needs to pay special attention towards ensuring openness and transparency, in all external dealings with stakeholders, especially the suppliers and contractors. Latest trends like e-procurement and associated activities, based on the use of information and communication technology (ICT), are of immense help, in ensuring hassle-free transactions.

Transparency international brought in guidelines for integrity pact (IP) to smoothen procurement activities and transactions between the manufacturer and contractor.

The Integrity Pact is a tool developed in the 1990s, by transparency international to help governments, businesses, and civil society, to fight corruption in the field of public contracting. IP establishes mutual contractual rights and obligations, to reduce the high cost and distortionary effects of corruption, in public contracting. The Mechanism of IP is intended to make public procurement transparent, by binding both parties to ethical conduct. It also envisages a monitoring role for civil society, who is the ultimate beneficiary of government action. IP should cover all activities, related to the contract, from pre-selection of bidders, bidding and contracting, implementation, completion and operation. Its primary objective is to ensure transparent and ethical governance and corruption-free environment.

For failure to implement IP, officials will be subject to penal action and bidders will face cancellation of the contract, forfeiture of the bond, liquidated damages, and blacklisting. Action will not require criminal conviction but it will be based on "no-contest" after the evidence is made available or there can be no material doubts. Disputes in IP implementation would be resolved, by arbitration detailed in IP.

Many organizations, both in public and private sectors, signed IPs, thereby committing them to corruption-free SCM.

Global Compact

Corporate sustainability starts with a company's value system and a principled approach to doing business. This means operating in ways that, at a minimum, meet fundamental responsibilities, in the areas of human rights, labor, environment, and anti-corruption. Responsible businesses enact the same values and principles, wherever they have a presence, and know that good practices in one area do not offset harm in another. By incorporating the global compact principles into strategies, policies, and procedures, and establishing a culture of integrity, companies are not only upholding their basic responsibilities to people and the planet but also setting the stage for long-term success.

The following UN global compact's ten principles are derived from: the universal declaration of human rights, the international labour organization's declaration on fundamental principles and rights at work, the Rio declaration on environment and development, and the United Nations convention against corruption: The following table 20.4 gives the ten principles of UN Global Compact.

Table: 20.4: Ten Principles of UN Global Compact

Principle 1:	Businesses should support and respect the protection of internationally proclaimed human rights; and
Principle 2:	Make sure that they are not complicit, in human rights abuses. Labor
Principle 3:	Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining
Principle 4:	The elimination of all forms of forced and compulsory labor
Principle 5:	The effective abolition of child labor
Principle 6:	The elimination of discrimination, in respect of employment and occupation Environment
Principle 7:	Businesses should support a precautionary approach to environmental challenges
Principle 8:	Undertake initiatives, to promote greater environmental responsibility
Principle 9:	Encourage the development and diffusion of environmentally friendly technologies Anti-Corruption
Principle 10:	Businesses should work against corruption in all its forms, including extortion and bribery.

Source: United Nation's Global Compact

Example: Gender Equity

Italy was known for supply chains and the higher proportion of women at the workplaces. There was observed gender inequality faced by women. Kering (luxury supply chains), its family of Italian brand supply chains: Bottega Veneta, Gucci, Kering Eyewear, and Pomellato, in partnership with BSR, embarked on a mission to understand the status of women at their own work places of supply chain and find opportunities to bring in gender equality within the country.

Kering partnered with Wise Growth, reviewed workplace gender equality policies of their 189 suppliers and collected the perceptions of 620 women and 260 men, across their supply chains. The outcomes, observations and Impact: Women did not enjoy same working conditions, and possible economic opportunities as men. Though women were 635 of the workforce, only 255 could be in management positions. Women could hold leadership positions rarely and did not have high professional career advancement opportunities. Across the employment cycle 59% women felt discriminated. Motherhood in particular was perceived as a burden by 39 percent of women. They were afraid of consequences upon returning to job and on professional growth. Shared parental responsibilities were rare, and for 69% women shouldering domestic, and family care responsibilities was impacting work-life balance. Kering was strongly committed to rewarding the talents of women by empowering, in supply chains

Source: https://www.bsr.org/en/our-insights/case-study-view/kering-italian-women-in-luxury-supply-chains February 2020, Accessed on 19/09/22

20.15 e-SCM, Mobile SCM, and Real-Time SCM

e-SCM

e-SCM is a supply chain, connected virtually through the internet with information flowing seamlessly, managed electronically, and using web technologies. An e-supply chain can be successful, if all the partners in the chain collaborate, share information electronically, be transparent, and work towards closer integration, focusing on the end consumer. Some of the components of eSCM are e-procurement, e-fulfilment, supply chain monitoring using RFID, Collaborative design, e-logistics, and B2B exchange. The infrastructure that needs to be in place, for effective e-SCM is electronic data interchange (EDI), internet usage, collaborative tools, workflow systems, and electronic company portals. E-SCM includes e-commerce, information sharing, and knowledge sharing. E-SCM is a pull model, where production and transportation are driven by customer demand and fast information flow helps in delivering to the customer, with reduced inventory costs and better material control.

Mobile SCM and Real-time SCM

Mobile SCM refers to combining RFID, e-commerce, and m-commerce, through an internet portal and ICT communication into a supply chain, in a mobile environment. Internet, wireless technology, and handheld devices have revolutionized the way communication can happen, enabling it without having physical connectivity for people, processes, and business. M-SCM is also based on a pull model, wherein it can extract information when needed. A networked computer system can interface with a mobile client and generate the necessary information in m-SCM. RFID and mobile devices together can ensure correct product quality, and that the right materials reach the right place and nothing is missing. RFID also helps in the real-time counting of stock in inventory. A mobile-enabled traffic control system can be used as a GPRS and which can automatically detect, track, and report locations of delivery vehicles in transportation. RFID at the retail level is used to automatically record sales, update inventory stock, and refill/ reorder as needed. At the customer end, using mobile, they can check for different products, availability, order, pay, and track the status. The way forward is to integrate mobile technologies like 3G mobile network, satellite mobile network, Infrared, Bluetooth, WiMax, and WLAN, with supply chain management systems.

Example: Real-Time Supply Chain in the Retail Industry

Albertsons was the second-largest American grocery and Pharmacies Company. Food and retail industry's supply chain was complex, slow and likely error-prone. Some of the error-prone scenarios included: Got emails for buying upgrades from hotel's booking engine after cancellation of the room, POS was not able to function because of power issues and internet - customers left without buying, not updating paper menu/online PDF as per current food availability etc,. There were tools like Apache Kafka, which helped optimize business processes, automation of tasks, and enhancing customer experience. Albertsons operated Kafka and Confluent as the real-time data hub. Inventory updates from all their stores were in near real-time, to ensure well managed out-of-stock and substitution recommendations. Data was fed in real-time to analytics engines, which were used for order forecasts, order management at warehouses, demand planning, and inventory management. Integrating all transactions in near real-time to their data lake, for generation of real time and up to date dashboards for stakeholders, helped at training the data models, and hyper-personalization.

Source: https://www.kai-waehner.de/blog/2022/02/25/real-time-supply-chain-with-apache-kafka-in-food-retail-industry/ January 2022, Accessed on 19/09/22

20.16 Role of Big Data and Analytics in SCM

The trend across the world of business is to leverage on information, which harps on enormous data, christened as Big Data. Data and associated analytics encompass every domain of organizational management. Supply chains, whether in manufacturing or servicing, are bound to benefit through this fast-emerging innovative approach. The span of supply chain management being so vast, every stage and associated activities generate a huge amount of data. The analytics carved out of this big data help in finding opportunities for improvement in every process in the supply chain. The essentials for efficient supply chain management need focus on parameters of quality, cost, delivery, flexibility, and customer service. These measurements provide valuable information to combat competition and facilitate the globalization of operations. The modern technologies, being deployed in manufacturing and service operations and associated supply chains, themselves provide in-built provisions for amassing data and providing online information for smooth production and maintenance.

Example: Predictive Analytics Using Big Data in Supply Chain

A Fortune 500 industrial supply company offered around 1.6 million products in stock, in categories: safety, material handling, and metalworking. By putting data analytics to work, companies were able to fine-tune their supply chains. Big data and predictive analytics, helped retailers, suppliers, and manufacturers in the supply chain management and made the supply chain more flexible and highly efficient.

Some identified advantages of big data and predictive analytics in supply chain management included: Demand forecasting, Delivery prediction, Predicting customer preferences, making more-informed business decision, Preventing supply chain interruptions, Predicting and mitigating risks and Pricing analytics.

The Fortune – 500 companies, depended on the services of N-iX, which was an Eastern European software development service company. They integrated daily data loads, backfill of historical data into a unified data platform. Teradata was put in to use to collect other systems data, generate reports with Business Object and Tableau.

The Benefits the Fortune-500 company could get were: The finance department could predict the inventory-related expenses, Infrastructure costs were nullified by moving to cloud, Unified data platform with all the data was in one place.

Source: https://www.n-ix.com/big-data-predictive-analytics-supply-chain-case-study/ November 2020, Accessed on 19/09/22

Activity 20.2

Key Performance Indicators (KPIs) are defined by every organization, to achieve a sustainable level of performance through efficient supply chains, as compared to the traditional supply chains, which were also delivering products and services, over the past few decades.

Why did sustainability KPIs attain prominence in SCM?

Justify your answer, in the light of growing global concerns about sustainability.

Answer:

Check Your Progress - 2

6. Towards achieving sustainability, companies have been adopting multipronged strategies. Which of the following is not a strategy to achieve sustainability?
   a. Mergers & Acquisitions
   b. Value chain
   c. Diversification
   d. Expansion
   e. Disinvestment
7. Which of the following are classified as network and external forces respectively, as per Hand Field's classification of forces influencing future supply chain trends?
   a. Increased customer expectation and volatility
   b. Volatility and globalization
   c. Volatility and increased customer expectation
   d. Volatility and customer participation
   e. Volatility and sustainability
8. Which of the following is one of the emerging trends in supply chain, as per Doyle?
   a. Improving supply chain visibility
   b. Decreasing supply chain visibility
   c. Decreasing supply chain risk

d. Increasing supply chain rigidity

e. Risk aversion in supply chain management

9. PwC's Global supply chain survey identifies one of the following, as a major trend in the future supply chain. Which one is it?

   a. Different customer segments require a uniform supply chain

   b. Different customer segments require different supply chains and one size does not fit all

   c. One size does not fill all: customer segments are different, but supply chains are common

   d. One size does fit all: all supply chains are different

   e. Make one size to fit all

10. Which of the following is not a 'sustainability KPI', in emerging supply chains?

    a. Emission reduction

    b. Return on Investment

    c. Water consumption

    d. Electricity consumption

    e. Security compliance

20.17 Summary

- Supply Chain Management is going to revolutionize the future business strategies, for achieving competitive advantage.
- Organizations have to gear up themselves, redesign their strategies and get ready, to understand and react to aspects like flexibility, adaptability, volatility, and agility, to get better outcomes from supply chain management.
- Traditional supply chain management, with an objective of improvement in the overall supply chain profit (SCP) by mutual coordination, cooperation, trust, integration, and information sharing, will have to move further and become more agile and dynamic, for the sustainability of existing supply chains.

20.18 Glossary

Bottom of the Pyramid: The poorest but largest population of the world calling the attention of policymakers, businesses, and the civilized society at large.

Cross-docking: A logistic technique adopted by Wal-Mart, in which goods are continuously delivered to warehouses, from where they are dispatched to stores without stocking.

Environmental Management System: Globally ISO 14000 standards are recognized as standards, for eco-friendly operations in supply chain management.

Green Supply Chain: Following eco-friendly practices, all along the supply chain.

Networked Economy: Indicates interdependency of all stakeholders in a supply chain.

Quality Management System: ISO 9000 series of standards are the standards for Quality Management, across different types of organizations, covering both manufacturing and service operations.

20.19 Self-Assessment Test

1. Compare and contrast the studies conducted by Handfield and Capgemini. Identify the common and contradictory findings. Express your own opinion, on how the supply chain is going to be in the future.
2. Critically analyze Handfield's study.
3. What do you understand by network economy, cross-docking, supply chain volatility, and flexible and agile supply chains?
4. What strategies can companies design to get adapted, to the emerging trends in the supply chain?
5. How are the emerging trends in the supply chain applicable to the Indian business environment?

20.20 Suggested Reading/Reference Material

1. Ashley McDonough, Operations and Supply Chain Management Essentials You Always Wanted to Know: 15 (Self Learning Management Series) Paperback – 1 January 2020.
2. Russel and Taylor, Operations and Supply Chain Management, 10 ed, ISV Paperback – October 2019.
3. Chopra and Kalra, Supply Chain Management 6/e Paperback – 17 June 2016.

20.21 Answers to Check Your Progress Questions

1. (a) Agile and dynamic

This should be focused for sustainability of supply chains.

2. (d) Product volume

Product volume is not a factor found to influence the future trends in supply chain management

3. (d) Short product life cycle

Short product life cycle is the problem faced by mobile phone manufacturers

4. (a) Mutual trust and win-win

Mutual trust and win-win are required for the management of conflicting objectives.

5. (c) Sustainability is a major concern

It is not a major finding of the Capgemini study.

6. (b) Value chain

Value chain is not identified as a strategy to achieve sustainability.

7. (a) Increased customer expectation and volatility

8. (a) Improving supply chain visibility

Improving supply chain visibility is an emerging trend in supply chain management.

9. (b) Different customer segments require different supply chains, and one size does not fit all

10. (b) Return on Investment

It is not sustainability KPI under emerging supply chains.

Supply Chain Management

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