UNIT 18 DESIGN FOR SUPPLY CHAIN MANAGEMENT AND GREENING THE SUPPLY CHAIN

Objectives

After reading this unit you will be able to:

- discuss various key elements to be considered for designing of supply chain management;
- portray factors influencing supply chain design decisions; and
- discuss the emerging trends in the field of supply chain management.

Structure

18.1 Introduction
18.2 Factors Influencing Supply Chain Design Decisions
18.3 Sustaining Competitive Advantage
18.4 Good Business Model / Strategy
18.5 Demand Driven Supply Networks
18.6 Secret to Supply Chain Excellence is Balance
18.7 Supply Chain Design
18.8 Supply Chain Strategies
18.9 Hau Lee's Uncertainty Framework
18.10 Aligning Strategies, Efficiency and Cost Savings in Supply Chain
18.11 Product and Process Design for Supply Chain Management
18.12 Design for Manufacturing
18.13 Design for Logistics
18.14 SCM –Trade off Curves
18.15 Greening the Supply Chain
18.16 Summary
18.17 Self Assessment Questions
18.18 References and Suggested Further Readings

18.1 INTRODUCTION

The rise of new technologies, new forms of competition, and new avenues to add customer value have begun to redefine the basis of supply chain designs and strategies. Product life cycles are being compressed. Services are becoming commodities in ever-shorter time spans. Intellectual capital and proprietary technologies, once protected by layers of patents and enshrouded in corporate secrecy, have become widely available.

Building and sustaining competitive advantage requires firms to learn and adapt at an ever-faster rate in order to distinguish themselves from competitors. Andy Grove, the chairman of Intel, in his popular book "Only the Paranoid Survive" uses the term 'inflection point' to characterize the nature of the profound, sudden changes in the environment that often spell a major crisis for the firms.

Inflection points signify the potential for a radical transformation of an industries structure. In view of above, to remain competitive, effective and robust designing of supply chain management gains tremendous importance.

To remain competitive, industrial organizations are continually faced with challenges to reduce product development time, improve product quality, and reduce production costs and lead times. Increasingly, the challenges cannot be effectively met by isolated change to specific organizational units, but instead depend critically on the relationships and interdependencies among different organizations (or organizational units). With the movement toward a global market economy, companies are increasingly inclined toward specific, high-value-adding manufacturing niches. This, in turn, increasingly transforms the above challenges into problems of establishing and maintaining efficient material flows along product supply chains. The ongoing competitiveness of an organization is tied to the dynamics of the supply chain(s) in which it participates, and recognition of this fact is leading to considerable change in the way organizations interact with their supply chain partners. The development of techniques and tools to enable modeling and analysis of emerging supply chain management strategies and practices, and application of these tools to understand critical tradeoffs is very important for designing supply chain management.

18.2 FACTORS INFLUENCING SUPPLY CHAIN DESIGN DECISIONS

There are many factors that influence the design of supply chain. Some of them are discussed in this section

Rising Importance of Knowledge Work

In many industries knowledge work has become the primary condition that defines how well firms innovate and compete with one another. The shift towards knowledge work places a greater emphasis on how well managers can attract and retain talent. In places such as the Silicon Valley and other hot beds of innovation, the recruitment, training and development of knowledge workers shape a firm's basis for future technologies and product ideas. Often firms attempt to recruit technical talent from their competitors, and from companies in other industries as well. This growing flow of people promotes rapid flow of ideas, insights and innovation.

Growth of Substitute Products and Services

Firms in related or neighboring industries often produce substitutes. The innovation of substitute products creates opportunities for new entrants and innovators to change the way firms must compete. For example, the rise of Internet based telephony, threatens traditional phone companies such as AT&T corp.; the growth of video on demand threatens the infrastructure of many entertainment and network-based firms.

Rising Information Intensity

The growing information intensive nature of many industries means that the costs of creating and disseminating information are steadily declining over time. The costs of creating and transmitting information on wider scale, appears to be declining as the information content becomes richer. For example, the value of E –mail as a service to the users grows as it becomes more pervasive and easier to use. The costs of transmitting and delivering E-mail to the wider population is declining as new networking technology substantially lower the cost of each message.

Impact of the Shifting Landscape

As companies deal with the numerous changes and challenges posed by epicenters of massive change, it is important that managers broaden the scope of their skills to accommodate and learn new insights that will help them become more effective.

We should expect to see the impact of frequent and massive change on an industry in three ways.

a) ***Commoditisation of new technologies*:** One major trend reshaping a variety of industries is the growing availability of state of the art technology to any one who wants it. Today's innovations are becoming commodity like products. For example, new technology products like virus-scanning software and fast modems to connect with Internet are rapidly becoming standard features in many of today's computer and electronics products.

b) ***Rapidly declining unit costs*:** Even some of the most sophisticated forms of knowledge are becoming widely available on the Internet for a very low cost, and in several cases for free.

c) ***Burden of strategic commitment:*** Change often requires new managerial mindsets and a willingness to challenge assumptions about how to add value to emerging customer needs. Often established firms become wedded to ingrained patterns of behavior. Core competencies built and refined from an earlier time become shackles and blinders that constraint learning. It is important for firms to continue monitoring how their products and services are likely to evolve over time.

From Physical To Virtual Value Chains

The perspective can be illustrated by the revolutions shaking the music recording and distribution industry. Traditionally, the industry has been dominated by AOL TIME WARNER, Sony etc., who signed long term royalty contracts with artists and entertainers, managed their own CD's and controlled marketing programs to ensure steady sales. With the advent of digital media formats and new technical standards, music firms must reconfirm their value chain approaches, by forming an array of alliances with Internet service providers and Internet portals to reach preferred customers, digital retailers etc.

Rise Of Virtual Organizations

Emerging organizational designs will increasingly be based on new configurations where information, knowledge, innovation and marketing all converge together along a shared network. This shared network brings together not only different parts of the firm, but also different firms that may be from different industries as well. These networks evolve and complete on the basis of fast innovation, sharing of ideas and rapid product development. The rise of the so-called *Virtual Organisation* is just one manifestation of this broader trend. As information, knowledge and value flow across many firms, any firm operating within the virtual organization is a potential source for future innovation, learning and inflection point that can dramatically change the skills and competencies needed to compete effectively.

18.3 SUSTAINING COMPETITIVE ADVANTAGE

Companies can only survive and prosper to the extent that they are able to change as fast or faster that the rate at which their industry is changing.

- They need to recognize that their customers are able to dictate prices and offerings, their products and services have already become commodities
- Companies are able to generate high profitability to the extent that they are able to differentiate themselves in a significant way from their competitor.
- They must balance their organizations designs to promote the kind of innovation, experimentation and thinking that will encourage self-renewal and reinvention.

Companies from variety of industries have implemented some new strategies to embrace change in order to learn and craft new sources of competitive advantage.

1) Pursue self-cannibalization opportunities.
2) Buy out the threat or new entrants.
3) Learn from new entrants.
4) Manage parallel product teams.

18.4 GOOD BUSINESS MODEL / STRATEGY

Every viable organization is built on a sound business model. A successful business model represents a better way than the existing alternatives. It may offer more value to a discrete group of customers. Or it may completely replace the old way of doing things and become the standard for the next generation of entrepreneurs to beat. Fargo's business model changed the rules of the game, in this case, the economics of travel. Traveler's cheques remained the preferred methods for taking money abroad for decades until a new technology—the automated teller machine—granted travelers even greater convenience.

But business model is not the same thing as a strategy, even though many people use the term interchangeably. Business models, however, do not factor in one critical dimension of business—competition. Sooner or later every enterprise runs into competitors. Dealing with that reality is strategy's job.

A competitive strategy explains how you will do better than your rivals by being different. The success of Wall Mart Stores and the success of Dell Computers are examples of superior strategies and timely changes in strategies to deal with new competitive realities, the underlying business model remaining the same.

18.5 DEMAND DRIVEN SUPPLY NETWORKS (DDSN)

Demand driven supply networks are supply chains driven by the voice of the customers. DDSN is a shorthand term for the next generation supply chain that has been taking shape for sometime. It simply means building all supply chain processes; infrastructure and information flow to serve the down stream – source of demand-whether a consumer is in the super market or the department of defence.

Rather than the upstream supply constraints of factories and distribution system, pioneers have been doing it this way for a decade or more & in the process redefining what is possible in the 21st century supply chain practice.

DDSN Matters to Growth, Profitability and Valuation

Early adopters are already saving 5% of top live revenue compared to laggards. The saving can be seen in more granular matrices as well like getting paid by customer 70 days sooner, holding half the inventory and delivering 92% perfect order verses the laggards average 91%.

There is powerful and significant correlation between perfect order performance return on assets earnings / shares and perfect margins. The takeaway! Higher levels of supply chain service (on time delivery order occurrence and in stock performance) correspond with lower level of supply chain cost (inventory, transportation and material handling) for best performers.

DDSN give companies cost time and efficiency advantages that boost profits. It also positions winners to grow with dramatically faster response to business opportunities ≠ at the level of lower stock outs for current products and as much as 70% faster

time to market for new products. More innovations with better perfect product launch performance means more business opportunities seized as customer or market demand evolves.

DDSN Matters to the Decisions Made About Technology

1) Is radio frequency identification (RFID) just a costly tax dropped on manufacturers by their mega customers or it is a unique opportunity to extend visibility into consumer demand?

2) Is enterprise resource planning (ERP) consolidation & upgrade an expensive IT projects with little clear benefit or is it a business backbone vital to supporting future growth?

3) Is product life-cycle management (PLM) an engineering jargon or is the critical infrastructure for accelerating product innovation?

Tackling such sweeping IT challenges without some guiding strategic principle is playing professional Russian roulette. Simple minded truisms like " business needs determine IT priorities " does not help at all. Supply chain professionals better have a far more decisive basis for prioritizing the 'to do' list.

The right basis combines strategic direction, best practices & technology

1) ***Strategic direction*****:** What is the long-term basis of competition for our business? Where will new growth come from, rather than just lower cost?

2) ***Best practices*****:** What role do lean or demand pull management principles play? What role does supply chain collaboration play, including collaborative planning, forecasting & replenishment (CPFR) or sales & operational planning (S&OP)? What about product platform strategies or stage gate product development?

3) ***Technology*****:** What existing supply chain execution (SCE) systems run in the warehouses, distribution centers & field service operations that can be nervous system for the demand driven future? What information they do not provide?

Approaching technology choices with answers to these three sets of questions in hand we make the business case & roll out plan a lot easier.

DDSN Matters to the Global Economy and the Employment Base

The critical measure of supply chain's importance to business is the impact on overall productivity – not simply labor productivity, but multifactor productivity. This number averages 4.2% per year from 1995 to 2000 for durable manufacturing. Through boom and bust, war and peace & every other upheaval we have seen the past 10 years, this trend still looks robust.

The essential fact is that output per unit input of labor and capital is growing three times faster than population & at least twice as fast as it did through the entire twentieth century. The steady march of supply chain efficiency from Ford's River Rouge mega factory to today's network of contract manufacturers, third party logistics services and outsource expertise is at an inflection point. Those, which do not keep the pace, will be acquired or closed and those, which do so, will consolidate their industries & built great corporate legacies.

For most of us this translates into more & better stuff with minimal or no inflation & high paying jobs. These will not be factory jobs, nor will they be white-collar back office functions all of which can be outsourced or automated with capital. These jobs are about translating customer needs into supply chain execution. Designers, marketers, coordinators, problem solvers, these are the kind of jobs behind the curtain of the new demand driven supply network.

DDSN Matters Because Dell, Wall-Mart, & Procter & Gamble are doing it now

Under the most impossible supply chain conditions imaginable –super short product life cycles (consumers pc's) and long lead time components (semiconductors including processors) –Dell managed to build the first true demand driven supply networks. This network embraces demand variability (35% of home and small business, customers cancel in the first 24 hours) like no push supply chain ever conceives. And it keeps getting better.

Also, Proctor and Gamble's "moments of truth" and Wall-mart's "everyday low prices" provide powerful strategic principles to set a course for long-term supply chain excellence. Their financial performance shows that it works.

Recommendations

Start with demand and work backwards to define supply chain strategy. Constraints are more fluid than ever, provided the visibility on demand is clear enough to quote accurate requirements backwards into the network. The notion of a "moment of truth" helps many companies to define exactly what matters at instant where supply needs demand.

While looking to capitalize on existing supply chain applications in order management, warehouse management and the like, prepare positions on the four emerging corner stones of technology that support DDSN:

- ***Unit Level Demand Visibility*:** RFID, POS, B2C, E- commerce, all represent demand at its most granular and therefore most precise. For some, this may be no different than bar fleeting spikes in demand.
- ***Demand Management*:** Forecasting, price, and revenue optimization, promotions management tools supporting these processes deepen the ability to manage the supply / demand balance by tapping into demand variability as a resource. Such tools are also essential to weather the storm of data from unit level demand.
- ***Product Lifecycle Management:*** Design for X means, defining the product and its supply and service network for speed, reuse and compliance. 80% of supply chain costs are set during early design phase of new product development, PLM focuses on getting this right.
- ***Executive Dashboards**:* Bench marking and balance performance, measurement is the ultimate expression of business judgment driving supply chain decisions. What data populates the dashboards and how it differs by role is a deceptively thorny and potentially political issue.

18.6 THE SECRET TO SUPPLY CHAIN EXCELLENCE IS BALANCE

Most companies either keep costs down at the expense of service or keep service levels up at the expense of costs. The tradeoff shows up most clearly in two key matrices.

1) Perfect order performance. (The percentage of orders that are complete, accurate, on time, and in perfect condition)
2) Supply chain cost.

Companies don't have to trade cost for service or vice –versa. The top companies keep their balance in the details, catapulting them to best overall.

Top performers do three things differently than every one else.

1) ***Aim for Balance*:** The best performers in costs and service are not best at each of the sub components of costs or service, but are consistently good enough at each sub component to add up to the best in total.

2) ***Increase Demand Visibility*:** Across industries, increasing demand forecast accurately yields significant improvements in perfect order fulfillment.

3) ***Isolate High Costs:*** Top performers know where they hold their cost and focus their best practice, technology and investments there.

To increase demand visibility, target the following best practices that connect you with your trading partners and connect supply and demand internally.

- Getting the demand information possible from your key customers.
- Sharing it with your suppliers and logistics providers as early as possible.
- Using a sales and operations planning.(S & OP)process to connect demand with production internally .Use application technology to reduce your high cost areas , but make sure you don't just move costs around.

Demand visibility is a major barrier in developing demand driven supply networks. (DDSN's**).**

Demand Visibility is Everyone's Top Concern in Moving Supply Chains Towards DDSN's.

Improvement means attacking the problem at three levels.

1) Replenishment based demand.
2) Surge demand.
3) Future demand

In perusing this DDSN model, the first step is improving this demand visibility. Demand visibility is the ability to see undistorted and accurate demand within the time frame necessary to react to it. Above three types of demand visibility must be conquered to achieve DDSN.

1) **Replenishment Based Demand:** The predictable demand that forms the base line for forecasting and planning. This may be electronic data interchange (EDI) orders or some other form of pull replenishment on steady run products. Visibility can be system to system or supported with manual planning and replenishment processes. For FMCG, replenishment level visibility is a definite technology issue that leaders are tackling with demand data hubs to consolidate and manage point of sale (POS) data.

2) **Surge Demand:** Sensing and managing events that change demand is more a matter of sophisticated demand modeling and forecasting and requires combining POS or other actual historical demand data with intelligence about customer behavior unique to events like weather, fashion, network effects, and promotions (yours and competitors). The role of technology is in the use of algorithm-based tools to model and prepare for such surge demand. Vendors with applications targeting this problem include specialists like DEMANTRA, TERRA TECHNOLOGY, and LOGILITY as well as larger supply chain suite vendors like i2 Technologies and MANUGISTICS, and enterprise resource planning (ERP) vendors like SAP, PEOPLESOFT and ORACLE.

3) **Future Demand:** Strategic planning for future products and their effect on buying behavior is another important aspect to ponder upon. Planning for future demand especially as it relates to manufacturers with long lead-time component

and processes is really a matter for Product Portfolio Management (PPM). With future products, demand planning depends mostly on working ways lead time realities against marketing intent and attempting to build a supply chain that is ready once orders starts rolling in. PPM applications are available from specialist like IDC or SOPHEON as well as with in the suits of most product life cycles management (PLM) and ERP vendors.

DDSN starts with getting a handle on demand visibility. Supply chain professionals need to clearly define what demand visibility means to their organization on at least these three levels before buying tools to help improve forecast accuracy.

Key Skills

Following should fit into the skill set of modern supply chain design manager.

1) ***Define:*** integrated supply chain management, its components and how they are integrated.

2) ***Understand*****:** the impact of demand on the supply chain and the considerable competitive advantages that can result from managing demand across companies.

3) ***Define Value:*** from the perspective of customers and learn how to manage the supply chain to deliver that value.

4) ***Learn*****:** to manage the sourcing and information technology functions with in the global supply chain.

5) ***Understand:*** the importance of managing relationships with suppliers and customers to create differential advantage.

18.7 SUPPLY CHAIN DESIGN

Successful supply chain design requires several decisions relating to the flow of information, product and funds. These decisions fall into three categories or phases depending on the frequency of each decision and time frame over which a decision phase has an impact.

1) ***Supply Chain Strategy or Design:*** A company's competitive strategy defines the set of customer needs that it seeks to satisfy through its products and services. The supply chain strategy includes supplier's strategy, operations strategy, and logistics strategy. Decisions regarding inventory, transportation, operating facilities and information flows in supply chain are all parts of supply chain strategy. Various functional strategies cannot be formulated in isolation. They must fit and support each other if a company is to succeed. Achieving a strategic fit between a company's competitive strategy and supply chain strategy is a key consideration. There are three basic steps to achieve this.

- Understanding the customer,
- Understanding the supply chain, and
- Achieving the strategic fit.

During the supply chain strategy design phase a company decides on how to structure the supply chain. It decides what the chains configuration will be and what processes each stage will perform. These decisions include the location and capacities of production and ware housing facilities, products to be manufactured or stored at various locations, modes of transportation and types of information systems to be utilized. Supply chain design decisions are typically made for long term and are very expensive to alter on short notice.

2) ***Supply Chain Planning:*** This starts with a forecast for the coming year of demand in different markets – with all the details of markets, supply locations, inventories, sub contracting of manufacturing etc.

3) ***Supply Chain Operations:*** The goal is to implement the operating policies in the best possible manner.

18.8 SUPPLY CHAIN STRATEGIES

Let us see some supply chain characteristics and strategies

Demand and supply uncertainty characteristics

Hau Lee points out that in addition to important demand characteristics, there are uncertainties revolving around the supply side that are equally important drivers for the right supply chain strategy.

Lee defines a stable supply process as one where the manufacturing process and the underline technology are mature and the supply base is well established. In contrast, an evolving supply process is where the manufacturing process and the underline technology are still under early development and are rapidly changing. As a result the supply base may be limited in both size and experience. In a stable supply process, manufacturing complexity tends to be low or manageable. Stable manufacturing processes tend to be highly automated, and long-term supply contracts are prevalent. In an evolving supply process, the manufacturing process requires a lot of fine-tuning and is often subject to breakdowns and uncertain yields. The supply base may not be reliable, as the suppliers themselves are going through process innovations. Following exhibit summarizes some of the differences between stable and evolving supply processes.

Lee argues that while functional products tend to have a more mature and stable supply process, but that is not always the case. For example, the annual demand for electricity and other utility products in a locality tend to be stable and predictable, but the supply of hydroelectric power, which relies on rainfall in a region, can be erratic year by year. Some food products also have a very stable demand, but the supply (both quality and quantity) of the products depends on yearly weather conditions. Similarly, there are also innovative products with a stable supply process. Fashion apparel products have a short selling season and their demand is highly unpredictable. However, the supply process is very stable, with a reliable supply base and a mature manufacturing process technology.

Table 18.1: Demand Uncertainty Characteristics

Sl. No.	Functional	Innovative
1	Low demand uncertainty	High demand uncertainty
2	More predictable demand	Difficult to forecast
3	Stable demand	Variable demand
4	Long product life	Short selling season
5	Low inventory cost	High inventory cost
6	Low profit margin	High profit margin
7	Low product variety	High product variety
8	Higher volume	Low volume
9	Low stock out cost	High stock out cost
10	Low obsolescence	High obsolescence

Table 18.2: Supply Uncertainty Characteristics

Sl.No.	Stable	Evolving
1	Less breakdowns	Vulnerable to breakdowns
2	Stable and higher yields	Variable and lower yields
3	Less quality problems	Potential quality Problems
4	More supply sources	Limited supply sources
5	Reliable suppliers	Unreliable Suppliers
6	Less process changes	More process changes
7	Less Capacity constraints	Potential capacity constraints
8	Easier to change over	Difficult to change over
9	Flexible	Inflexible
10	Dependable lead times	Variable lead times

Types of Supply Chain Strategies

Lee characterizes four types of supply chain strategies as shown in the exhibit below. Information technologies play an important role in shaping such strategies.

1) ***Efficient Supply Chains:*** These are supply chains that utilize strategies aimed at creating the highest cost efficiency. For such efficiencies to be achieved, non value added activities should be eliminated, scale economies should be pursued, optimization techniques should be deployed to get the best capacity utilization in production and distribution, and information linkages should be established to ensure the most efficient, accurate, and cost effective transmission of information across the supply chain.

2) ***Risk Hedging Supply Chains:*** These are supply chains that utilize the strategies aimed at pooling and sharing resources in a supply chain so that the risks in supply disruption can be shared. A single entity in a supply chain can be vulnerable to supply disruptions, but if there is more than one supply source or if alternative supply resources are available, then the risk of disruption is reduced.

3) ***Responsive Supply Chains:*** These are supply chains that utilize strategies aimed at being responsive and flexible to the changing and diverse needs of the customers. To be responsive, companies' use build to order and mass customization processes as a means to meet the specific requirements of customers.

4) ***Agile Supply Chains:*** These are supply chains that utilize strategies aimed at being responsive and flexible to customer needs, while the risk of supply shortages or disruptions are hedged by pooling inventory and other capacity resources. These supply chains have strategies in place that combine the strengths of "hedged" and "responsive" supply chains. They are Agile because they have the ability to be responsive to the changing, diverse, and unpredictable demands of customers on the front end, while minimizing the back end risks of supply disruptions.

18.9 HAU LEE'S UNCERTAINTY FRAMEWORK

Let us consider some examples and types of supply chain needed. According to Lee, it is more challenging to operate a supply chain that is in the right column of the table 18.3 than in the left column, and similarly, it is more challenging to operate a supply chain that is in the lower row of the exhibit than in the upper row. Before setting up a supply chain strategy, it is necessary to understand the sources of the underlying

uncertainties and explore ways to reduce these uncertainties. If it is possible to move the uncertainty characteristics of the product from the right column to the left or from the lower row to the upper, then the supply chain performance will improve.

Table 18.3: Type of Supply Chain Needed

		Demand Uncertainty	
		Low (Functional Products)	***High (Innovative Products)***
Supply Uncertainty	***Low (Stable Process)***	Grocery basic apparel, food Oil and gas **Efficient Supply Chain**	Fashion Apparel, Computers, Popular music **Responsive Supply Chain**
	High (Evolving Process)	Hydroelectric power, Some Food produce **Risk Hedging Supply Chain**	Telecom, high end computers, semiconductors **Agile supply chain**

18.10 ALLIGNING STRATEGIES, EFFICIENCY AND COST SAVINGS IN SUPPLY CHAIN

Companies today are often presented with a myriad of supply chain strategies. How can we learn more about these strategies and decide which one will help us the most? Are we operating the most appropriate type of supply chain? Are we spending time and money on strategies that are not providing maximum benefits?

We will begin with looking at products and supply chain characteristics and learning a frame work for aligning the right strategies for your needs. We will then learn strategies to improve efficiency and reduce costs. We will play a version of classic Bear Game simulation used by business schools and executive training programs. Through simulation we will see first hand the causes of Bullwhip effect, which leads to major supply chain inefficiencies, including unpredictable lead times, stock outs, miss trust between supply chain partners and higher manufacturing and transportation costs. Once we have covered the causes of these problems we will learn the best strategies to mitigate or remove them.

Then we have to understand what type of supply chain we should be targeting, a critical first step in any supply chain initiative because putting teams to work on wrong initiatives can cause us valuable time and money. However even with in a company, several different types of supply chains may be called for, having a complete understanding of a wide range of strategies is just as important. Then in some cases, responsiveness is more important than efficiency and we have to understand the ways to improve supply chain responsiveness.

Aligning strategies, efficiency and cost savings, we will explore set of concepts that will help improve customer responsiveness and deal with highly uncertain demand. We will learn a powerful tool for hedging demand uncertainty so that we minimize total cost by taking into account both the opportunity / cost of stock outs and costs of access inventory then we will learn several advanced emerging strategies that apply to a wide range of supply chain. We will see how to understand and cope with supply chain uncertainty to make our product process more reliable, use active demand management methods to minimize the impact of shortages and discover new types of supplier arrangements that share this among supply chain partners while providing benefit to all players. Finally, we will see which of the strategies we've learnt are not software intensive and understand how we should go about evaluating software for those cases where it is a critical part of the improvement strategy. This can prevent costly mistakes that don't move the company forward.

18.11 PRODUCT AND PROCESS DESIGN FOR SUPPLY CHAIN MANAGEMENT

Product design for supply chain management means building products that thrive in and enhance our supply chain architecture. Simply 'giving customers what they want', which is fundamental to customer satisfaction, is rarely enough. Companies must be able to give customers the right products in the most resource effective manner with out sacrificing quality or service. If our supplier, manufacturing and post sales support networks are being stressed to the breaking point, if our products require excessive inventories to maintain service levels, if our offerings are not attracting new buyers in a saturated market or if our need to reduce cost and complexity throughout the supply chain, designing products to take advantage of and strengthen our supply chain can provide extra ordinary benefits.

Three fundamental concepts are to be explored.

1) Component commonality.
2) Modularity versus integral design.
3) Universality.

A framework for costs and benefits will help understand the value of these ideas and what to expect as we integrate them into our product design plans. We will see an excellent example of postponement, a strategy that can enhance service levels with lower inventories. We will also learn how to quickly estimate the positive impact of a postponement strategy in the company with out analyzing sales data or using complex calculations. We will see examples of how postponement can be implemented through software applied to product packaging and even how it can help during a new product launch.

Product design is not the only place we can make improvements. The production process itself is often overlooked as an incredible opportunity for enhancement. Re-sequencing production operations, shifting the push pull points, or even something as simple as administrative postponement can all provide significant benefits.

Mass Customization is often a hybrid of product and process design finding ways to offer unique items with little or no additional lead-time can increase market share and breathe new life in our products.

Focus on Various Ways that Product Design Interacts with Supply Chain Management

Firstly, consider various designs for logistics concepts, in which product design is used to lower the cost of logistics. Product designs for efficient packaging and storage obviously costs less to transport and store. Designing products so that certain manufacturing steps can be completed in parallel to cut down to manufacturing lead-time, leading to a reduction in safety stocks and increased responsiveness to market changes.

Secondly, postponing product differentiations enables risk pooling across products leading to lower inventories and allows firms to use the information contained in aggregate forecasts more effectively. Another critical design /supply chain interaction involves integrating suppliers into the product design and development process. There are different ways in which the suppliers can be integrated into the development process and considered keys to managing this integration effectively.

Finally, advanced supply chain management helps to facilitate mass customization. **Mass customization** involves the delivery of a wide variety of customized goods or services quickly and efficiently at low costs. This approach helps to provide firms

important competitive advantages and effective supply chain management is critical if mass customization is to be success full. Mass customization or BTO (Built to order), means designing your production operation to allow for customer orders to be manufactured quickly. This is a means of eliminating demand uncertainty entirely.

Following are the important tools for coping with demand and supply uncertainty.

1) Outsourcing
2) Global sourcing
3) Mass customization
4) Postponement

Demand and supply uncertainty is a good framework for understanding Supply Chain Strategy. Innovative products with unpredictable demand and an evolving supply process face a major challenge. Because of shorter and shorter product life cycles, the pressure for dynamically adjusting and adopting a company's supply chain strategy is great. Therefore, the concepts of outsourcing, global sourcing, mass customization and postponement should be explored fully. They are important tools for coping with demand and supply uncertainty.

However, a **good supply chain design** for one company may not work for another. How supply chain should be structured to meet the needs of different products and customer groups, is what supply chain design is all about.

A good supply chain design helps a firm to have competitive advantage. Weaknesses in supply chain design can affect the performance of a firm. Keeping the above in mind, strategic framework for supply chain management is developed.

Within the strategic framework, we identify **the key drivers of supply chain performance** i.e.

- Inventory
- Transportation,
- Information, and
- Facilities.

Then these drivers are used on a conceptual level during supply chain design and different supply chain Methodologies are used along with analytical tools and techniques to design and improve supply chain performance.

18.12 DESIGN FOR MANUFACTURING

Earlier, design engineers worked on developing a product that worked and product that used materials as inexpensive as possible. Then, they worked on how to make this design efficient. Then a stage came when management's realized that product and process designs were key product cost drivers and manufacturing process should be taken into account early in the design process to make it more efficient.

Earlier, we assumed that product design decisions were already made and designed supply chain design and operation based on this assumption. We also assumed that the supply chain involves determining the best way to supply existing products using existing manufacturing processes. Now, we realize that a much more efficient effective supply chain is possible to operate if we take logistics and supply chain management concerns into account in the product and process design phase itself.

18.13 DESIGN FOR LOGISTICS

Design for logistics concepts suggest product and process design approaches that help control logistics costs and increased service levels this concept should be incorporated into early phases of product development. This concept involves consideration of material procurement and distribution costs during the product design phase. Product packaging and transportation requirements need to be incorporated into the design process .How a product is designed and the design of the components and materials themselves can have a significant impact on the cost to deliver the product. In efficient supply chain design, heavy emphasis is given on minimizing inventory and handling costs.

18.14 SUPPLY CHAIN MANAGEMENT: TRADE OFF CURVES

One of the fundamental tradeoffs in supply chain management is that between inventory levels and customer service. For any given supply chain, increasing the level of service (product/spare part availability) typically means higher levels of inventory. Most companies have discovered their "best place" on the curve, depending on what their customers require and what their competition offers. However, supply chain strategies can shift the entire curve, lowering your inventory levels without adversely affecting your customers (or the reverse, improving customer service levels with no increase in inventory). How might this work? Through effective supply chain management you may be able to reduce lead times. This would shift the curve to the right, speeding up customer response times without raising inventories. Supply Chain reviews a strategy called postponement, or risk pooling that can lower the curve allowing you to maintain (or enhance) service levels with less finished-goods inventory.

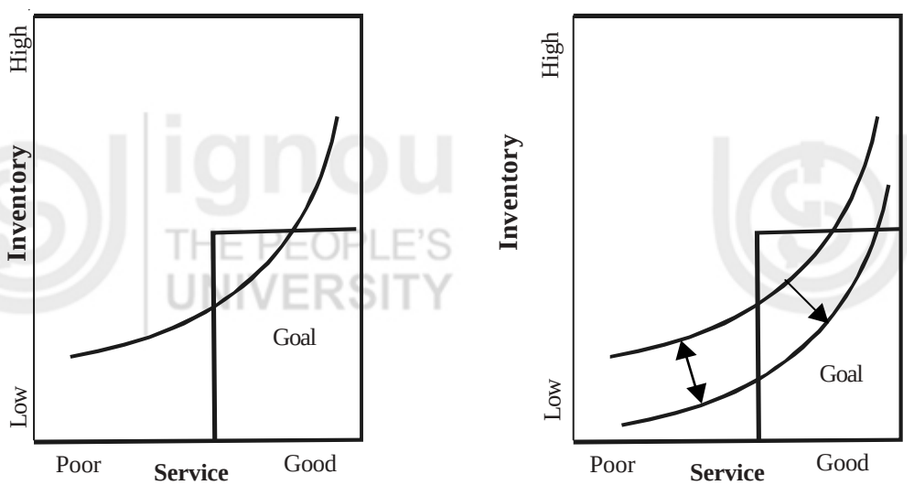

Figure 18.1: Lowering the inventory/service trade-off curve provides better customer response with lower inventories

This tradeoff curve provides a perfect example of how *silo behavior* (in which functional areas lose sight of cross-functional optimizations) can cause problems in supply chains. One of the first steps in improving a supply chain is making sure that organizational responsibility for inventory levels and customer service are appropriately managed. These two responsibilities should not be separated - in fact, they should report to the same desk. Doing so enables a company to set expectations and properly manage this tradeoff, without costly swings from one place on the curve to another as different functional groups "fight" for either lower inventories or higher service.

18.15 GREENING THE SUPPLY CHAIN

Greening the supply chain involves incorporation of environmental protection and conservation initiatives into existing supply chain management activities and design, procurement and distribution processes.

Involvement of suppliers in environmental initiatives and need to look beyond their own facilities is being realized by growing number of companies to achieve their environmental goals and satisfies stakeholders' expectations. This involves

- Screening suppliers for environmental performance.
- Working with them on green design initiatives.
- Providing training and information to build suppliers environmental capacity.

This involves clear, constant, frequent two-way communication with them about environmental issues and performance expectations. Working with them on environmental issues not only generates significant environmental benefits, but also opportunities for cost containment, improved risk management and enhanced quality and brand image. Customer and stakeholders do not always differentiate between a company and its suppliers and hold the company accountable for suppliers environmental and labor practices. Therefore, many companies are working to streamline their supply base and develop more cooperative long-term relationships with key suppliers to achieve the green design initiatives.

18.16 SUMMARY

Redefining the basis of supply chain designs and strategies is prevalent now because of rise of new technologies, new forms of competition, and new avenues to add customer value. You have studied many factors that influence the design of supply chain. This is important as companies can only survive and prosper to the extent that they are able to change as fast or faster than the rate at which their industry is changing. You have studied Demand Driven Supply Networks (DDSN) that are supply chains driven by the voice of the customers. DDSN is a shorthand term for the next generation supply chain that has been taking shape for sometime. It simply means building all supply chain processes; infrastructure & information flow to serve the down stream – source of demand- whether a consumer is in the super market or the department of defence. You further studied about balance in Supply Chains as most companies either keep costs down at the expense of service or keep service levels up at the expense of costs. Successful supply chain design requires several decisions relating to the flow of information's, product and funds, hence we have covered effective supply chain strategies and Hau Lee's uncertainty framework. Finally you learnt about various ways that product design interacts with supply chain management and supply chain management trade off curves.

18.17 SELF-ASSESSMENT QUESTIONS

1) Identify and describe factors influencing supply chain network design decisions.
2) Describe how a company achieves strategic fit between its supply chain strategy and its competitive strategy.
3) Identify and describe the major drivers of supply chain performance.
4) Describe how outsourcing works. Why would a firm want to outsource?

5) What are the advantages of using the Postponement Strategy?

6) What are the characteristics of Efficient, Responsive, Risk Hedging and Agile Supply Chains?

7) Can a supply chain be both efficient and responsive? Risk - Hedging and Agile? Why or Why not?

8) What are the basic building blocks of an effective mass customization program?

9) What kind of company wide cooperation is required for a successful mass customization program?

18.18 REFERENCES AND SUGGESTED FURTHER READINGS

1) Simchi-Levi, D; Kaminsky, P. and Simchi-Levi, E. (2000) *Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies*, Irwin McGraw-Hill, Singapore.

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3) Richard B. Chase , F. Robert Jacobs , Nicholas J .Aquilano, *Operations Management for Competitive Advantage* , Tata Mc GrawHill Publishing Company Ltd.