

**Indian Institute of Science  
Bangalore**

**NPTEL  
National Programme on  
Technology Enhanced Learning**

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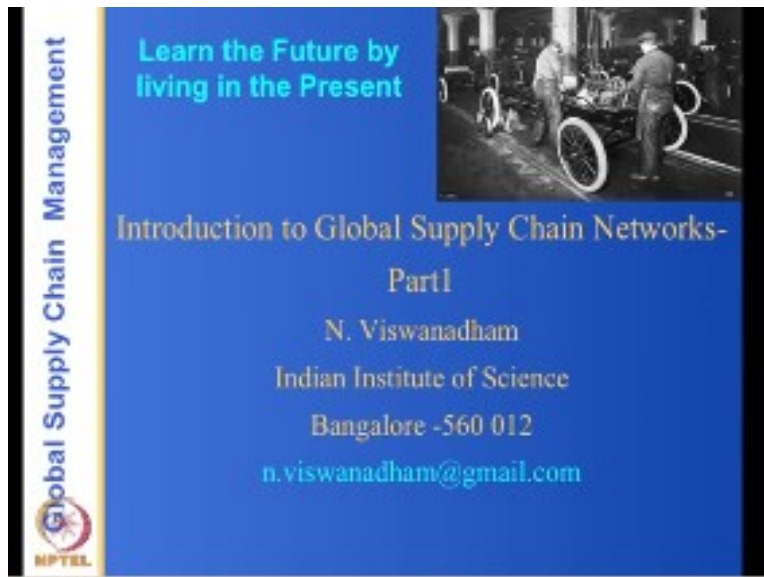


**Global Supply Chain Management  
Lecture -01  
Introduction to Global Supply Chain Networks Part-1**

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Welcome to the on-line course on global supply chain management. My name is Viswanadham, from the department of computer science and automation at the Indian Institute of Science. We will start with the first lecture today.

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You can see the picture of the Henry Ford's assembly line which was started in 1913 i.e. exactly 100 years ago. Indeed the Henry Ford's assembly line is the precursor to all the supply chain management in the world . It has basically revolutionized the industry in the United States and also the United States economy.

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We will start this lecture with an introduction to the supply chain networks (SCN). We first define the SCN and explain its properties with some examples. so that the people are clear of the concepts. We then introduce the concept of integrated supply chain networks as a network that integrates the flow of goods , finance and information. Finally, we learn about the best practices in the supply chain networks

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## What are Supply Chain Networks?

- Behind Every Product there is a Supply Chain
- Earlier, the network is fully owned by one company (Ford)
- Currently, it is a network of companies, located in different countries, involved in product design, manufacture & delivery to customers.
  - E.g. Auto, Pharma, aerospace, electronics, computer, food, apparel ,etc.
- Components may be sourced from several countries, assembled in another country, and distributed to the customers all over the world.
- Network coordination is important .

What are supply chain networks?

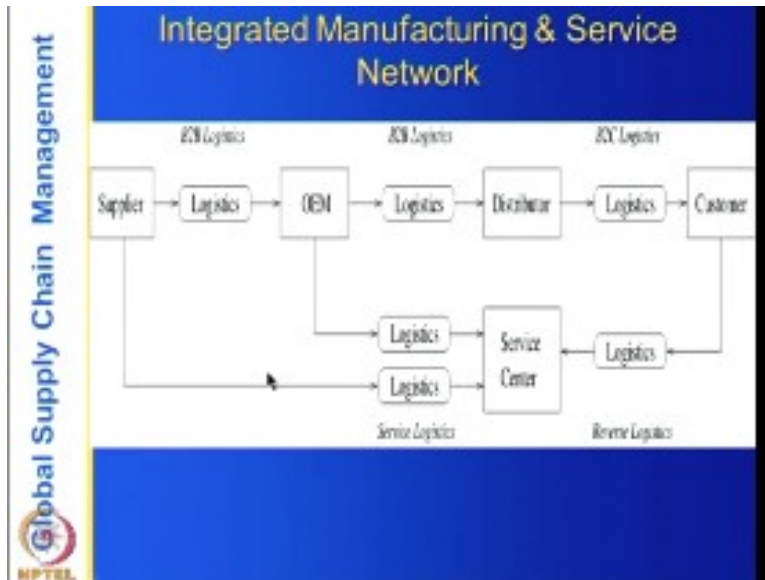
Behind every product, whether it is Car or PC or Laptop, there is a supply chain network i.e. several companies working together to produce that product.

For example, If you take the laptop there is Intel which makes the processor, some other companies to make the hard drive, to produce the screen, battery, mouse and all other required components. Finally, some other company assembles all the components and delivers the laptop to the consumer. It is very important we learn about the supply chain because the quality, cost and the usability of the product are all basically influenced by the supply chain.

In old times, all the companies in the supply chain are owned by a single company. For example, Henry Ford owned all companies including iron ores, steel plants, assembly lines and distribution networks till the car goes to the dealer. But currently the supply chain is not owned by one single organization but is a network of independent companies located globally, collaborating to design, produce and deliver the quality products to the consumer.

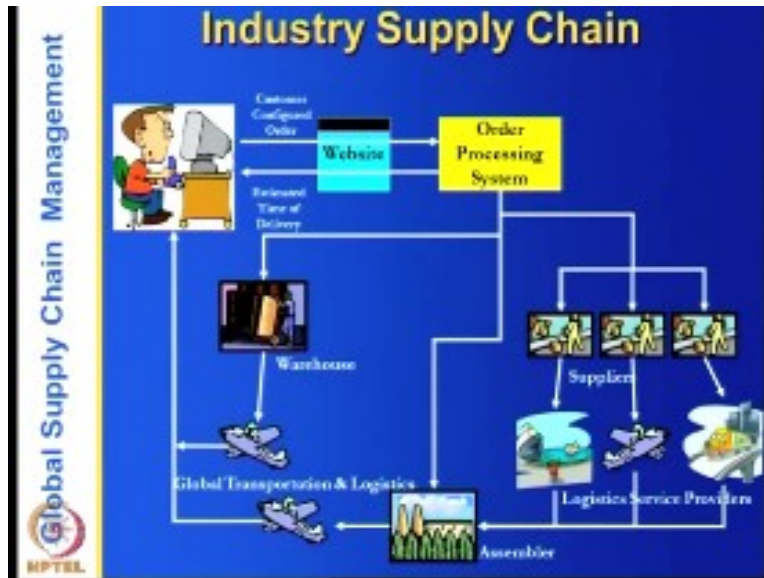
Thus, there are a network of companies behind any product from any industry, whether it is auto or pharma, aerospace, electronics food or apparel. Components may be sourced from several countries, assembled in another country and distributed customer all over the world. Thus network coordination is an important issue.

To give you an idea of what our supply chain networks let me show you a diagram.



Based on the product design supplied by the Original Equipment Manufacturer (OEM), suppliers manufacture the components and deliver them to OEM. The Original Equipment Manufacturer does the assembly to produce the final product and deliver them to the distributors and finally to the customer. The goods delivery from suppliers to OEM is done by the inbound logistics or business-to-business logistics firms. From the manufacturer the products go to the distributor from the distributor to the retailer and consumer via B2C logistics firms which own trucks or by rail or by air.

For products that require repair and maintenance, the products are delivered to the service centers. The service center connects for spare parts with either the manufacturer or the suppliers. The diagram shows the forward logistics which includes the B2B and B2C logistics and the service logistics which is called the reverse logistics.



Let us look at some examples

Suppose we have an industry supply chain where the customer order on-line from a e-retailer, a Lenovo laptop. Once the order is approved, you pay the money through your credit card or it can be cash-on-delivery. If the product is available in the warehouse then it is supplied to you immediately. Suppose it is not available in the warehouse and has to be assembled to order and delivered to you. The product also can be built to order and delivered to the customer. We thus have three kinds of Industry supply chains. The diagram also shows the delivery logistics.

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The second example is an agricultural supply chain and also called plow to plate food supply chain. The farmers are the suppliers of agriculture products and whatever is produced they transport them to the Farmers market (Mandi) or the distribution centers. The distribution center is the market place where goods are sold to the consumers through the retailers. This is called the plow to plate supply chain.

The *farm to fork* food supply chain in emerging markets such as India starts with the farmers and ends with consumers buying from retail shops. The supply chain is fragmented and there is no single governing body. The supply chain is not *designed* but exists as a result of social culture, business practices, and regulations. It is not as well organized as the previous industry the supply chain network

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We can identify two types of industrial supply chains: *domestic* and *global*. In a domestic or local supply chain, all the companies are co-located domestically catering to the local market. A global supply chain is internationally dispersed

In a global supply chain network, the stake holders can be from different countries. The suppliers can be either in India or in China. They supply components to the manufacturers. Inbound logistics players who basically take the material from the suppliers to the manufacturers. The manufacturing hubs assemble the components from the suppliers and transport them to the industry inventory hub or the dealers or the distribution centers and finally to the customer.

For most of the global supply chain networks, the retail is on the either in Europe or in or in USA. The tail end of the supply chain is in USA and the suppliers are in the in Asia. There is the material movement is involved from the suppliers to the assemblers to distribution centers and to the retailers in the global supply chain network. The material movement that is involved is handled by the logistics players called the third party logistics players. UPS DHL and several others have a large role to play.



The slide features a blue background with white text. On the left side, there is a vertical banner with the text 'Global Supply Chain Management' and the NPTEL logo. The main title is 'Horizontal & Vertical Globalization'. Below the title, there are three bullet points. In the bottom right corner, there is a small inset image of a man in a white shirt speaking.

**Global Supply Chain Management**

### Horizontal & Vertical Globalization

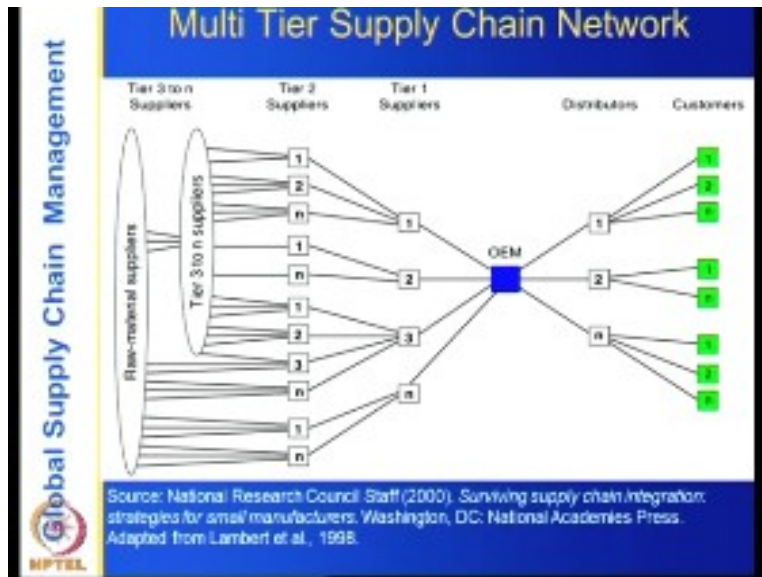
- In Horizontal FDI, MNCs duplicate the same activities in multiple countries.
- In vertical FDI, firms locate different stages of production in different countries.
- The basic difference between the two is
  - Horizontal integration always occurs at the same stage on the supply chain
  - Vertical integration always occurs at different stages of the supply chain.

So if you look at global supply chains there are two kinds of globalization: Horizontal and vertical. In Horizontal globalization, through foreign direct investment (FDI), Multinational companies (MNC), duplicate the same activities in multiple countries. In other words if they have a factory to manufacture a car in Japan they will just go to India and duplicate the same kind of factory even the suppliers.

But on the other hand, what is more prevalent nowadays is what is called vertical foreign direct investment where firms are located in different stages of production in different countries. For eg. the Intel chip is made in Malaysia, the power supply is made in India and the monitor is made in Thailand and all these are brought to the a particular country where it is all assembled and which is close to the customer and they are delivered to the customer.

So basically the vertical integration or vertical globalization is the one that is happening nowadays and it is interesting to study the various optimization and performance studies in vertical globalization.





This slide is an important slide because it shows you what is called a multi-tier supply chain network. The manufacturer orders and assembles the product from several sub-assembly manufacturers. Each of these sub-assembly manufacturers require components and they procure them from tier 2 suppliers and each of the tier 2 suppliers procure required materials from tier 3 to n suppliers. Finally, this procurement ends with the raw material suppliers.

So there are several levels of the supply chain here but usually people the manufacturers worry about tier one suppliers. The tier one suppliers will worry about tier two and tier three and so on but one should remember that even if tier 3 supplier was located in some place like Bangladesh or in Japan and if there is a tsunami there, affects entire supply chain. That is why it is important to map the multi-tier supply chain where all players shown.

Suppose a supplier's bank fails, he cannot supply the products and the supply chain leader need to procure from some other supplier. Hence it is important to monitor the economic, physical and environmental conditions of all your suppliers. You should have a record of all players who are supplying to you or and their locations. It is important that the multi-tier supply chain is mapped well. Of course in the forward direction you have the distributors and finally the customers through the retailers so this is the this is an important diagram for the supply chain researchers.



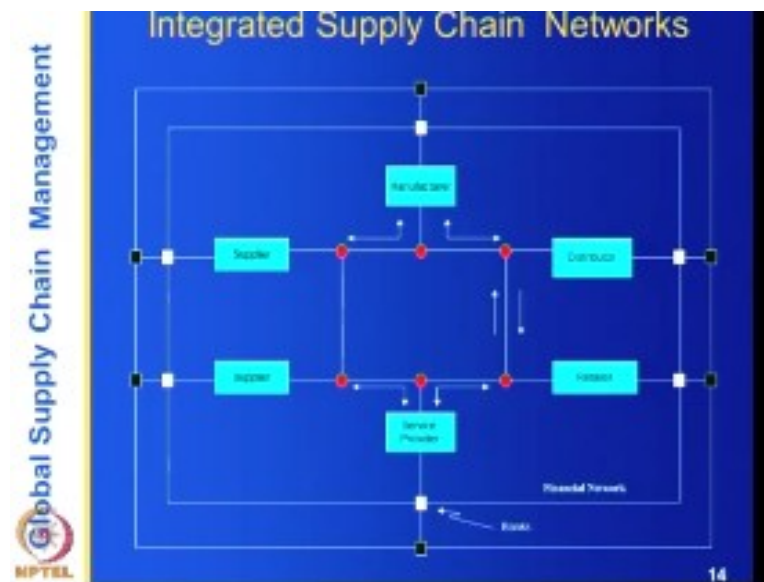
So once we have this kind of introduction to the supply chain Network and I have shown you several examples in the agricultural industry in the Global this one has shown you the three examples, and I have also told you that we have a multi supply chain it is not one player it is several players which are companies and these companies are independent players in other words if there is a supplier of auto components is located in Japan and if your manufacturer is in India then there has to be a collaboration but the magnetic supplier has no basically binding relationship with the manufacturer there could be contracts and it has to be a contractual relationship.

And so on so when you are studying the suppliers and it is a kind of a social network the supply chain network is a kind of social network but the social network is not persons usually Face book and other social networks are between persons but it is not persons here it is organizations independent organizations which are globally separated and located in different countries with different cultures so how do you integrate such a supply chain network and if you look at the previous diagrams.

There are three flows that happen in a supply chain Network first one is Goods flow that is the material flow it goes from suppliers to the manufacturers a components flow and from the manufacturer to the distributors the final products flow from the distributors to the retailers the

customized products flow and finally to the customers. So there is the goods flow involved in the supply chain and second one that is important that a note is the information flow so we have the information exchanged between all the partners either through faxes or through internet or through telephone calls or through videos. The third one and the most important one is the finance flow. It is important because unless money is paid nothing moves. The financial transactions among companies usually happens through banks or financial institutions so let us look at how these three flows are integrated in the supply chain networks.

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In the supply chain network you have suppliers, manufacturers, distributors and retailers. Also you have service providers. The service providers could be basically logistics providers who provide for the transport like truck owners or it could be trains or it could be ships whatever so you have all these players and all these players are all globally distributed they are not specially co-located they are all at various places over the globe and the next thing that happens is because the goods need to move from one player to the other in other words from suppliers. to the manufacturers and manufacturers to distributors distributor to the retailers and also to the service providers and so and so it is important you have a network and this network is called the logistics network and the red dots that. I am showing here the red dots, these are called hubs. Banks are connected because financial transactions and also insurance transactions had to happen in the supply chain and that happens through the financial network.

This diagram is an important diagram here because it shows that the connectivity the between the various players in the supply chain network you have the three kinds of players here the one is the manufacturers the distributors retailers the suppliers and the service providers and the financial service providers and also the IT the information and communication networks.

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### Three (Material, Information & Financial) Flows


- **Logistics network** provides a streamlined material flow between all partners, reducing lead time and cost.
- **Communications network** provides information integration between companies of supply chain network
- **Financial network** connects all institutions providing Funds, letters of credit and Insurance.

A well-designed supply chain network integrates three different flows: the material flow, information flow and financial flow. The logistics network provides a streamlined material flow between all partners, cutting down the lead time and cost of moving the raw materials, subassemblies, and finished goods to their destinations. Secure and reliable communications network links all the companies of the enterprise, provides the information integration. There is also a secure financial network that connects financial institutions, insurance and credit rating agencies and all the other stake holders and financial institutions

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## Three Sub Networks

- **Demand sub-network:** consists of manufacturing, distribution, retailing , logistics and finance. Perfect delivery is important .
- **Supply sub-network :** B2B network consisting of suppliers, manufacturers, inbound logistics, Financial Institutions and Freight forwarders.
- **Service sub-network:** connects consumer with suppliers & manufacturers after sales service centers.



Operationally, the integrated supply chain network has three sub networks: the demand network, supply network and the service network. The demand sub network is the fulfillment arm of the supply chain consisting of the manufacturing, distribution and retailing and the associate logistical and finance functions. Perfect delivery to the customer is very important here. The supply sub network consists of the suppliers, manufacturers, inbound logistics and the providers of the documentation needed for exports, imports and funds transfer. This activity can be termed as primarily business to business. The service sub network connects the end consumer with the suppliers; manufacturers for spare parts procurement and also the after sales service centers.

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## The Three Business Processes

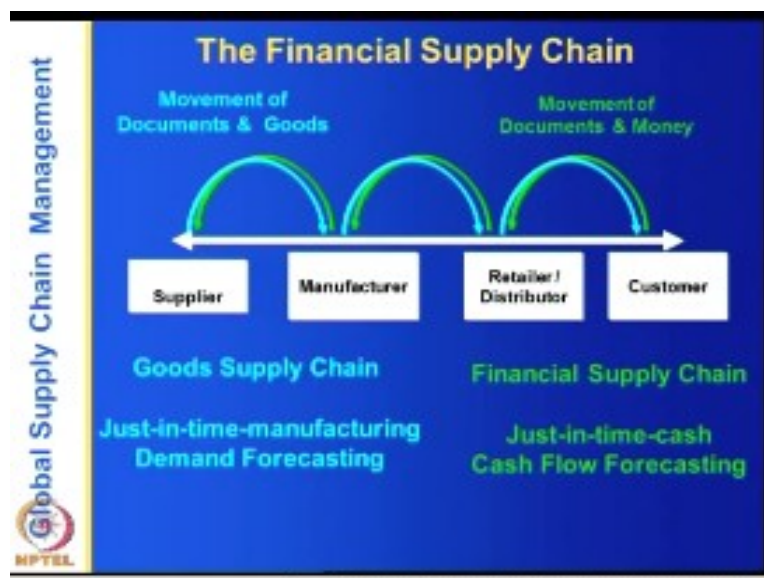
- **Procurement:** Sourcing raw materials and components from the suppliers ; Vendor & logistics provider selection, Delivery scheduling & Inventory management.
- **Manufacturing:** Could be in a single location or geographically distributed.
- **Distribution & Retail:** consists of packaging, transportation and warehousing. Options include direct shipping or outsourcing to third parties.



There are three important business processes in the supply chain. They are Procurement, Manufacturing or assembly and Distribution and retail.

- a. **Procurement:** The procurement function involves the acquisition of raw materials and components from the suppliers to produce the product or service. Purchasing includes duties such as vendor selection, material selection, outsourcing, negotiation, buying, delivery scheduling, inventory and materials management.
- b. **Manufacturing:** manufacturing is the set of production processes which use inputs from the suppliers, and produces goods for sale. The manufacturing function could be in a single location or geographically distributed. Scattered manufacturing is common in global supply chain networks.
- c. **Distribution and Retail:** Distribution consists of packaging and outbound logistics. Outbound logistics, includes activities such as transportation planning, packaging, location analysis, and warehousing, as well as inventory management.

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Now let us look at the finance supply chain here what happens is that

You have basically four or five players the suppliers, manufacturers, retailers, and distributors. The material flows from supplier to the customer. The movements of documents and goods happen in a forward direction. What about the money. It is paid to the retailers first by the consumer and it flows back to the suppliers after 3-6 months. That is why the suppliers have to take loans from the banks. So it is important to do see that the goods more move in one direction forward direction and the financial finance the funds move in a backward direction less.

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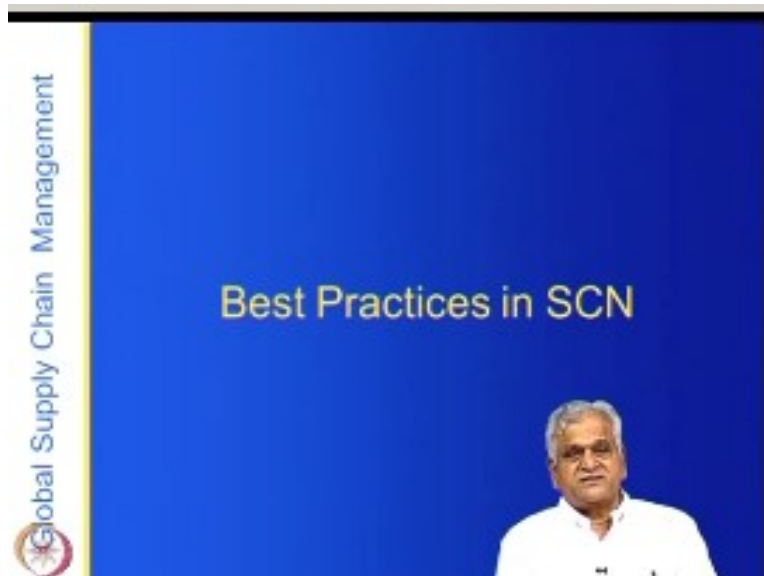
The Six Dominant Players

- Suppliers
- Logistics Players: B2B and B2C
- Contract manufacturers
- Original Equipment Manufacturers
- Distributors
- Retailers

**They are independent companies globally distributed & highly connected**

We can group them as six dominant players this and these are all independent companies and they are globally distributed and they are all highly connected now this connection is becomes very important. You are a manufacturer in India and if you want to source from China how do you know about the suppliers in China what is their quality what are the banks this one what is their financial status and what is their record

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What we will show is the best practices in the in the supply chain Network.



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## Best Practices in SCN-1

- **Supply hubs:** Third Party maintains inventory for the suppliers at the manufacturer site.
- **Modularization:** Design of component modules that can be used in multiple products
- **Standardization:** specifying common parts for use in multiple products and models.
- **Cross docks:** Transshipment facilities where goods are sorted, consolidated and loaded onto outbound trucks

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### Best Practices in SCN-1

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#### Best Practices in SCN-2

- **Postponement:** Final assembly done adding customer specific features such as labeling garments, packaging with customized manuals based on the customer order
- **Merge-in-transit:** Components shipped from different production units & warehouses are assembled during transit
- **Collaborative Planning, Forecasting & Replenishment** combines the collaborative intelligence of multiple trading partners in planning and fulfillment of customer demand

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