UNIT-4 Managing Manufacturing and Delivery Operations

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Understand what is production design
- ✓ Identify the Production Scheduling procedures
- ✓ Explore the Delivery Scheduling Procedures

Unit 4

Managing Manufacturing and Delivery Operations

Product Design

Whenever a product is to be built the design and components needed for its development depend upon the available technology and the requirement for product performance.

Initially less focus used to be given to product design and selection of its element though these factors affect the supply chain. If you are considering product design from the perspective of supply chain, the objective is based on designing the product with fewer parts, modular construction from generic sub assemblies and simpler designs.

In this way, the parts can be achieved from a small group of chosen suppliers. Inventory can be reserved in the shape of generic sub-assemblies at suitable sites in the supply chain. There will not be the requirement to hold big finished goods inventories since customer demand can be fulfilled quickly by assembling finished products from generic sub-assemblies as client orders arrive.

The supply chain needed to support merchandise is moulded by the design of the product. The more responsive, flexible, and cost effective the supply chain is, the greater is the chance that the product will have success in the market. To demonstrate this point, consider the scenario mentioned below.

A corporation designs an extraordinary home entertainment system offered with wide screen TV and high quality sound. It performs to challenging specifications and delivers striking results. But the electronics that are the gist behind this entertainment centre are produced with elements from 12 different vendors.

The company increases the production when there is increase in demand. Managing functions of quality control and delivery schedules for 12 different suppliers is a challenge. More procurement staff and managers are hired. Assembly of the elements is complicated and delays in the components' delivery from any of the vendors can slow the speed of production rates, So additional stocks of finished products are kept to compensate this. A number of new suppliers were needed to offer the particular product components. One of them is causing the company to face quality control problems and needs to be replaced and another supplier decides following several months to stop production of the component it supplies to the corporation. They launched a new part with similar features but not an accurate replacement. The Company has to delay production of the home entertainment system while a squad of engineers redesigns the element of the system that used the ceased component so that it can make use of the new component. During this time, buffer stocks run short of in some locations and sales started to lost when clients go elsewhere.

There is a natural propensity for procurement design, and manufacturing people to have dissimilar agendas except their actions are harmonized. Design people are anxious about meeting the requirements of customers. Procurement people are involved in getting the most excellent prices from a group of pre-screened favoured suppliers. Folks in manufacturing want to have trouble-free fabrication and assembly approaches and long production runs. Cross functional design teams with the representatives belonging to these three groups have the prospect to mix the best insights from every group. Cross functional teams can re-examine the new product plan and discuss the related issues. Can existing chosen suppliers supply the components required? How many new suppliers are required? What prospects are there to make simpler the design and decrease the number of suppliers? What happens if a dealer stops producing a particular component? How can the product assembly be made easier?

At the same time they are checking product designs, a cross functional team can assess current preferred suppliers and production facilities. What components can present suppliers provide? What are the levels of their services and technical support capabilities? How large a labour force and what type of skills are required to make the product? How much power is needed and which facilities must be used? A product design that does a good job of organizing the three perspectives—design, procurement, and manufacturing—will yield in a product that can be maintained by a capable supply chain. This will give the product a fast time to market and a cut-throat cost.

Production Scheduling (Make)

Production scheduling assigns accessible capacity (equipment, facilities and labour) to the work that is required to be done. The objective is to use accessible capacity in the most well-organized and money-making manner. The production setting up operation is a course of finding the correct balance between a numbers of competing objectives:

- **High Utilization Rates**—this frequently means long production runs and centralised production and distribution centres. The plan is to create and make advantage from economies of scale.
- **Low Inventory Levels**—this usually implies short production runs and just-in-time delivery of materials. The thought is to reduce the assets and cash used in inventory.
- **High Levels of Customer Service**—Often needs high inventory levels or a lot of short production runs. The plan is to offer the customer with fast delivery of products and not to run out of stock in any product.

When a particular product is to be produced in a dedicated facility, scheduling means systematizing operations as economically as possible and running the resource at the level needed to meet the product demand. When a number of different products are to be completed in a single service or on a single assembly line, this becomes complex. Every product will called to be produced for some span of time and then time will be essentially required to switch over to manufacturing of the next product.

The primary step in arranging a multi-product manufacturing facility is to decide the economic lot size for the manufacturing runs of every product. The calculation of economic lot size involves balancing the production set-up costs for a product with the cost of carrying that product in inventory.

If set ups are completed frequently and manufacturing runs are done in little batches, the result will be low inventory level but the production costs will be higher because of enlarged set-up activity. If production costs are reduced by doing long production runs, then inventory levels will be higher and product inventory carrying costs will be higher. Once production quantities have been decided, the second step is to set the correct sequence of production runs for every product. The fundamental rule is that if inventory for a particular product is low as compared to its estimated demand, then manufacturing of this product should be planned ahead of other products that have higher inventory levels relative to their estimated demand. A general practice is to schedule production runs is based on the notion of a product's "run out time." This is the time that represents number of days or weeks it would take to reduce the product inventory on hand given its anticipated demand. The calculation for run out time for a product is expressed as

$R = P / D$

where:

R = run out time

P = number of units of product on hand

D = product demand in units for a day or week

The scheduling procedure is a repetitive procedure that starts with a calculation of the run out times for all products—their R values. The first production run is then planned for the product with the lowest R value. Assume that the economic lot size for that product has been produced and then recalculate all product R values. Again, choose the product with the lowest R value, and schedule its production run next. Assume the economic lot size is produced for this product and once more recalculate all product R values. This scheduling procedure can be repeated as often as essential to create a production schedule going as far into the future as needed.

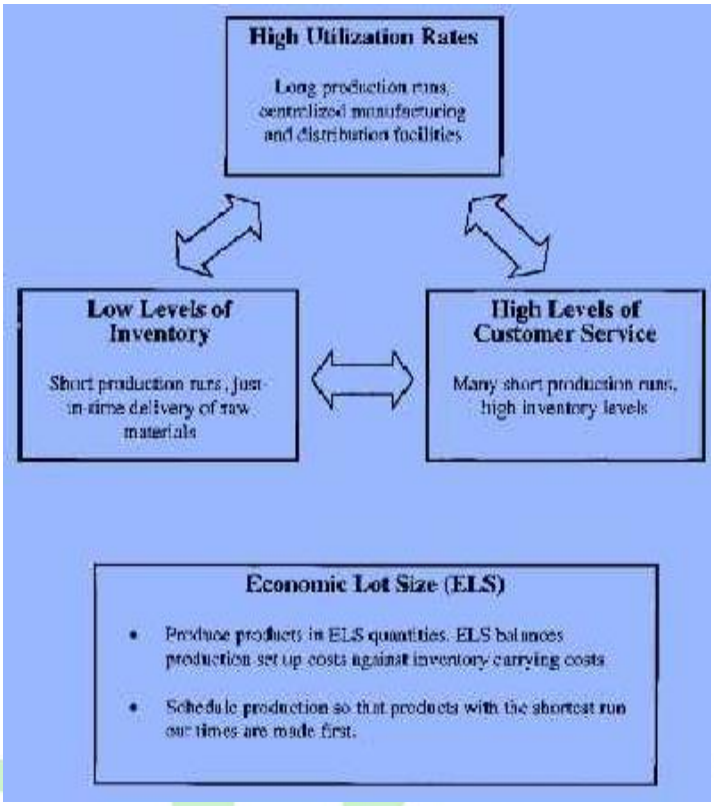

Fig 4.1: Production Scheduling

After setting up is done, the resulting inventory must be constantly monitored against definite demand. Is inventory building up too quick? Should the demand number be transformed in the calculation of run out time? Reality hardly ever happens as designed so production schedules required to be constantly attuned.

Facility Management (Make)

Location is one of the five supply chain drivers as examined earlier. It is usually fairly expensive to close a facility or to construct a new one so businesses live with the outcomes of decisions they make about where to put their facilities. Ongoing facility administration takes location as an entity and pays attention on how best to make use of the capacity available.

This is carried out by making decisions in three areas:

1. The role that will be played by each facility
2. How capacity is allocated in each facility
3. The allotment of suppliers and markets to each facility.

The role every facility will play consists of decisions that decide what activities will be carried out in which facilities. These decisions will have a big affect on the flexibility of the supply chain.

These decisions will help in defining the ways that the supply chain can alter its operations to meet varying market demand. If a facility is elected to carry out only a single function or supply only to a single market, it generally cannot easily be moved to carry out a different function or serve a diverse market if supply chain wants change.

How capacity is assigned in every facility is uttered by the role that the facility plays. Capacity allocation decisions result in the labour and equipment and are employed at the facility. It is simpler to vary capacity allocation decisions than to modify location decisions but still it is not cheap to make recurrent changes in allocation. So, once determined, capacity allocation powerfully influences supply chain profitability and performance. Allocating too small capacity to a facility leads to inability to meet market demand and loss of sales. Too much of it results in lower rates of utilization and higher costs of supply chain.

The allotment of suppliers and markets to every facility is subjective to the first two decisions. On the basis of role that a facility plays and the capacity assigned to it, the facility will need definite kinds of suppliers and the products and volumes that it can hold mean that it can maintain certain kinds of markets. Decisions regarding suppliers and markets to assign to a facility will influence the costs for moving supplies to the facility and transporting ready products from the facility to clients. These decisions also influence the general supply chain's ability to serve market demands.

Order Management (Deliver)

The procedure for passing information from customers back to the supply chain, from retailers to distributers to service providers and producers is called order management .This procedure also includes distributing information regarding product substitutions, order delivery dates, and back orders forward through the supply chain to consumers. This procedure has long relied on the utilization of the telephone and paper documents like purchase orders, change orders, sales orders, pick tickets, packing lists, and invoices.

A business generates a buying order and calls a vendor to fill the order. The provider who gets the call either meets the order from its own inventory or sources needed products from other suppliers. If the vendor fills the order from its inventory, it turns the customer buying order into a pick ticket, a packing list, and an invoice. If products are obtained from other suppliers, the original customer buying order is turned into a buying order from the first supplier to the next supplier. That supplier in turn will either fill the order from its inventory or source products from other suppliers. The purchase order it receives is again turned into documents such as pick tickets, packing lists, and invoices. This process is recurring through the length of the supply chain.

The conventional order management procedure has longer lead and interval times built into it because of the slow movement of data back and forth in the supply chain. This sluggish movement of data works well sufficient in some simple supply chains, but in multifaceted supply chains faster and more precise

movement of data is essential to attain the responsiveness and competence that is necessary. Contemporary order management focuses on systems to enable faster and more correct movement of order associated data.

In addition, the order management process needs to do exemption handling and offer people with ways to rapidly spot problems and give them the details they need to take remedial action. This means the handling out of routine orders should be automatic and orders that need special handling due to issues such as inadequate inventory, missed delivery dates, or buyer change requests required to be brought to the notice of people who can tackle these issues.

Four rules for effective order management

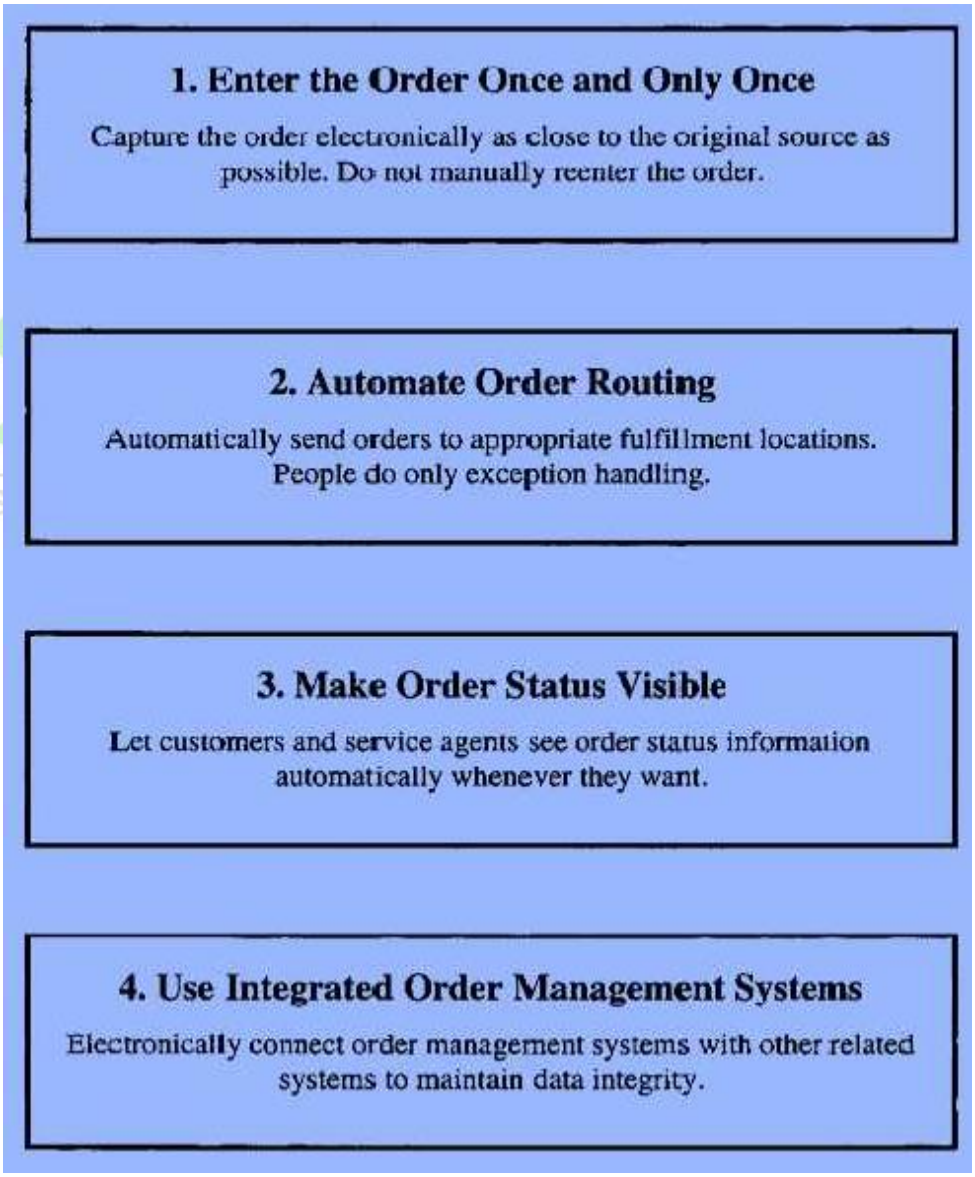

Fig: 4.2

Because of these requirements, order management is starting to overlap and combine with a function called customer relationship management (CRM) that is frequently thought of as a marketing and sales function. Due to supply chain difficulty and shifting market demands, order management is a procedure that is evolving quickly. However, a handful of essential principles can be listed that direct this operation:

- **Enter the Order Data Once and Only Once**: Track the data electronically as close to its original source as possible and do not by hand re enter the data as it progresses through the supply chain. It is typically best if the consumers themselves put their orders into an order entry system. This system should then move the pertinent order data to other systems and supply chain participants as required for generation of purchase orders, pick tickets, invoices, and so on.
- **Automate the Order Handling**: Manual interference should be kept at lowest level for the routing and satisfying routine orders. Computer systems should transmit required data to the suitable locations to complete routine orders. Exception handling must identify orders with troubles that require people to take steps to fix them.
- **Make Order Status Visible to Customers and Service Agents:** Let consumers track their own orders through all the phases right from entry of the order to delivery of their desired products. Customers must be able to view order status on demand without having to join the help of other people. When an order runs into troubles, bring the order to the notice of service agents who can tackle the problems.
- **Integrate Order Management Systems with Other Related Systems to Maintain Data Integrity**: Order entry systems require product descriptive data and prices of products to guide the consumer in making choices. The systems that preserve this product data must be in touch with order management systems. Order data is required by other systems to revise inventory status, calculate delivery schedules, and make invoices. Order data should mechanically flow into these systems in a precise and timely way.

Delivery Scheduling (Deliver)

The delivery preparation operation is of course sturdily affected by the decisions made regarding the modes of transport that will be used. The delivery scheduling procedure works within the limitations set by transportation decisions. For most of the modes of transportation there are two kinds of delivery methods: direct deliveries and milk run deliveries.

Direct Deliveries

Direct deliveries are made from a single originating location to a single receiving location. With this means of delivery the routing is just a matter of selecting the shortest and direct path between those two locations. Scheduling this kind of delivery involves decisions regarding the quantity to deliver and the occurrence of deliveries to every location. The benefits of this delivery method are the ease of operations and delivery harmonization. Since this means shifts products directly from the location where

they are completed or stored in inventory to a site where the products will be consumed, it abolishes any middle operations that unite different smaller shipments into a single, joint larger shipment.

Direct deliveries are well-organized if the delivery location makes economic order quantities (EOQs) that are the similar size as the shipment quantities required to make finest use of the transportation form being employed. For example, if a delivery location gets deliveries by truck and its EOQ is the similar size as a truck load (TL) then the direct delivery process makes sense. If the EOQ does not equal TL quantities, then this delivery method becomes less competent. Receiving charges incurred at the delivery location are high because this location handles separate deliveries from the diverse suppliers of all the products it requires.

Milk Run Deliveries

These are the deliveries which are either routed to bring products from single originating location to multiple receiving locations. Scheduling milk run deliveries is a much more complex task than scheduling direct deliveries.

The benefits of this mode of delivery are in the fact that more well-organized use can be made of transportation used and the price of receiving deliveries is lower since receiving locations get larger and fewer deliveries. If the EOQs of various products required by a delivery location are less than truck load (LTL) amounts, milk run deliveries let orders for different products to be united until the resultant quantity equals a truck load or TL amount. If there are numerous delivery locations that every needs smaller amounts of products, they can all be served by a solo truck that begins its delivery route with a TL amount of products.

There are two major methods for routing milk run deliveries. Every routing technique has its benefits and drawbacks ad every method is more or less successful depending on the circumstances in which it is used and the correctness of the data that is accessible. Both of these techniques are supported by software packages. These two techniques are:

1. The savings matrix technique
2. The generalized assignment technique

The savings matrix technique is the easier of the two techniques and can be utilized to allocate customers to vehicles and to plan routes where there are delivery time windows at delivery locations and other limitations. The method is healthy and can be tailored to take into account a lot of different constraints. It provides a sensibly good routing explanation that can be put to sensible use. Its flaw lies in the fact that it is often likely to discover more cost effective solutions using the widespread assignment technique. This method is best used when there are a lot of different constraints that require to be fulfilled by the delivery schedule.

The generalized assignment method is classier and usually gives an improved solution than the savings matrix system when there are no restraints on the delivery schedule other than the transport capacity of the delivery vehicle. The difficulty of this technique is that it has a harder time making good delivery schedules as more and more restraints are included. This practice is best employed when the delivery constraints are restricted to vehicle capacity or to overall travel time.

Delivery Sources

Deliveries are made to customers from two sources:

1. Single product locations
2. Distribution centres

Locations for a single product are facilities like factories warehouses or where a single product or a thin range of related items are accessible for shipment. These facilities are suitable when there is an expected and high demand levels for the products they offer and where shipments will be made just to customer locations that can obtain the products in large, mass amounts. They offer vast economies of scale when used efficiently.

Distribution centres are those facilities where mass shipments of products enter from single product locations. When there is a long distance between suppliers and customers, the utilization of a distribution centre offers for economies of scale in long-distance transportation to carry large amounts of products to a site near to the final customers.

The distribution centre might warehouse inventory for potential shipment or it might be used mainly for cross docking. Cross docking is a method pioneered by Wal-Mart where truckload shipments of single products enter and then are unloaded. At the same time these trucks are being unloaded, their mass shipments are being split into smaller lots and joint with small lots of other products and loaded right back onto other trucks. These trucks then deliver the products to their destinations.

Distribution centres that utilize cross docking offer numerous benefits. The first is that product flows quicker in the supply chain since small amount of inventory is held in storage space. The second is that handling expense can be saved since product does not have to be put away and then recovered later from storage. The advantages of cross docking can be comprehended when there are large expected product volumes and when economies of scale can be achieved on both the inbound and outbound transportation. However, cross docking is a difficult technique and it requires a substantial degree of synchronization between inbound and outbound shipments. Transporting and delivering goods is costly so capabilities in this area are directly associated with the real needs of the market that the supply chain serves. Highly responsive supply chains generally have high transport and delivery costs since their consumers expect fast delivery. This results in a lot of small shipments of product. Less responsive supply chains can combine orders over a period of time and make fewer and big shipments. This results in lower transport costs and more economies of scale.

Return Processing (Deliver)

All supply chains have to deal with the returns. This procedure is also called "reverse logistics." This is often a tricky and unproductive process and in the Supply-Chain Council's SCOR model a whole class of activities has been dedicated to this procedure. End customers, distributors, retailers, and manufacturers all return products under definite circumstances. The most general circumstances are:

- the wrong products were delivered;
- the products that were delivered were broken in transit or were faulty from the factory;
- more product was delivered than was required by the customer.

All of these conditions arise from supply chain inefficiencies that formed the need to return products.

Companies and supply chains as a whole require to keep the follow up of the types of returns that occur, their occurrence, and if the return rates are increasing or falling. Return processing should be resourceful and yet at the same time keep in mind that if other supply chain activities are administered efficiently there will not be the need for a lot of return processing. Optimizing the return procedure can turn out to be an exercise in recovering the efficiency of a procedure that should not be happening in the first place. If return rates are growing it is far more successful to find and fix the sources of the troubles that make returns needed.

Returns are a value added action for the whole supply chain is where product recycling is there. In this area returns occur at the end of the product life cycle as the final user sends the product back to the producer or some other business that will either recycle or securely dispose of the product. With the increased environmental awareness companies and have adopted green policies there will be a progressively growing volume of recycling activity. And recycling companies will appear to grip this activity not as return processing but rather as a sourcing activity. This will be the approach by which they obtain their raw materials.

Supply Chain Operations Can Be Outsourced

After knowing about the 11 fundamental supply chain operations in this unit and the prior one, which of these operations are done by internal staff in your company? How many of these operations are central competencies? How many of these operations carry money into your business and how many of them consume money?

The persistent pressure on revenue margins that free markets produce is a driving force behind the expansion of outsourcing. What might be considered as overhead for Company A might be a service that Company B can recommend and make a profit doing so. Company B might be able to propose this service for a price lower than it costs Company A to do it in-house. Company A is going to think about outsourcing.

The conventional participants in supply chains are producers, distributors, logistics providers, and retailers. How many of the 10 supply chain operations can be termed as core competencies of any of these organizations? There are certain operations like credit and collections, order management and product design, that might not be a core competency of any of the conventional participants. This creates opportunities for new service providers to go for these operations and propose them to the other supply chain participants. All 10 of these operations need to be completed for the supply chain as a whole, but they do not all required to be done by any single company and certainly they cannot all be done well by any single company.

The other force that encourages outsourcing is the increasing sophistication of the markets that are served by the supply chains. Days have gone when Ford Motor Company could run a vertically integrated business that did all from mine iron ore to create steel to design and construct automobiles. That structure was simply possible since the markets it served were satisfied to buy bulk quantities of standard products. As Henry Ford stated when he was asked about what colours his consumers could choose from. He said:

"They can have any colour they want as long as it's black."

Markets today require and pay for all kinds of innovations; tailored features, and services. This creates difficulty in the participants and supply chain and who concentrate in certain areas carry the proficiencies and efficiencies that are necessary to direct this complexity.

Further Reading:

- ✓ ***Modern Logistics Management: Integrating Marketing, Manufacturing and Physical Distribution,(1985), By John F. Magee, William C. Copacino, Donald B. Rosenfield***
- ✓ ***Manufacturing planning and control for supply chain management, (2011), By F. Robert Jacobs, William Berry, D. Clay Whybark, Thomas Vollmann***
- ✓ ***Logistics Management,(2008) By Reji Ismail***