Modelling and Analytics for Supply Chain Management
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Lecture 06
Design Options for Distridution Network

Welcome to module six of our course on Modelling and Analytics for supply chain management. We will be today dealing with design options for distribution network. Basically today we are going to describe in short the different configurations of distribution network and some of the advantages, disadvantages and the performance characteristics associated with each of this design configurations.

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Mainly we will be dealing with six different types of designs. The first one is manufacturer storage with direct shipping. The next one is manufacturer storage with direct shipping and in-transit merge. The third one is distributor storage with carrier delivery. The fourth one distributor storage with last-mile delivery. The fifth one is manufacturer or distributor storage with customer pickup and retail storage with customer pickup.

The details of each and every kind of design configuration can be obtained from any good textbook on supply chain management mainly I have picked up from Chopra and Meindl's book on supply chain management, but you can consult any text book on supply chain management to get the details of this different configuration. But, here in we will mainly concentrate on certain points which are necessary for you to apply analytics in the design of this network.

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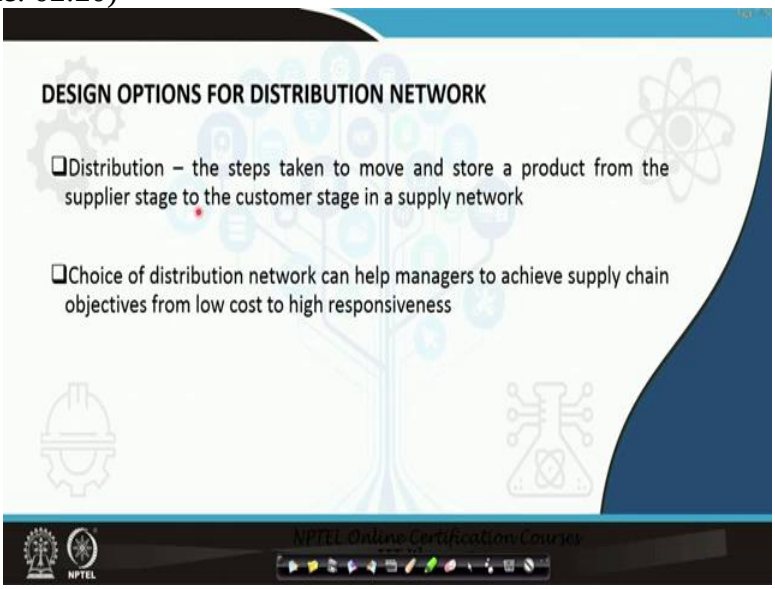

First we should know what is distribution? Distribution basically refers to the steps taken to move and store a product from the supplier stage to the customer stage in a supply network and this choice of distribution network can help managers to achieve supply chain objectives from being a low cost or an efficient supply chain to high responsiveness. How you will do the trade of? What kind of supply chain is responsible for which type of product? If it is an efficient supply chain what should be the design configuration and things like that.

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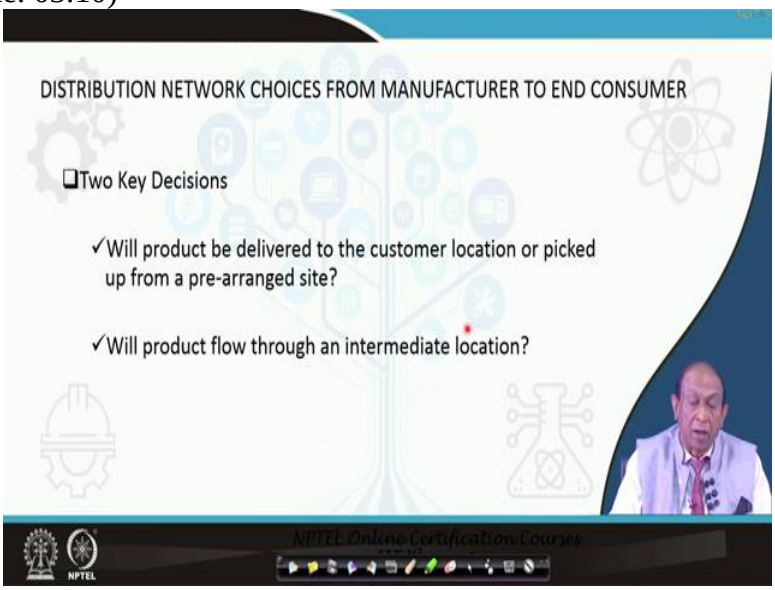

So when you are thinking of designing a network, supply network or a distribution network there are mainly two key decisions that you have to take. One is will product be delivered to the customer location or picked up from a pickup site which is already pre-arranged and the second important point is, will product flow through some intermediate location or stores or

warehouse. So this intermediate nodes where they should be placed is also a very important criteria in designing a network.

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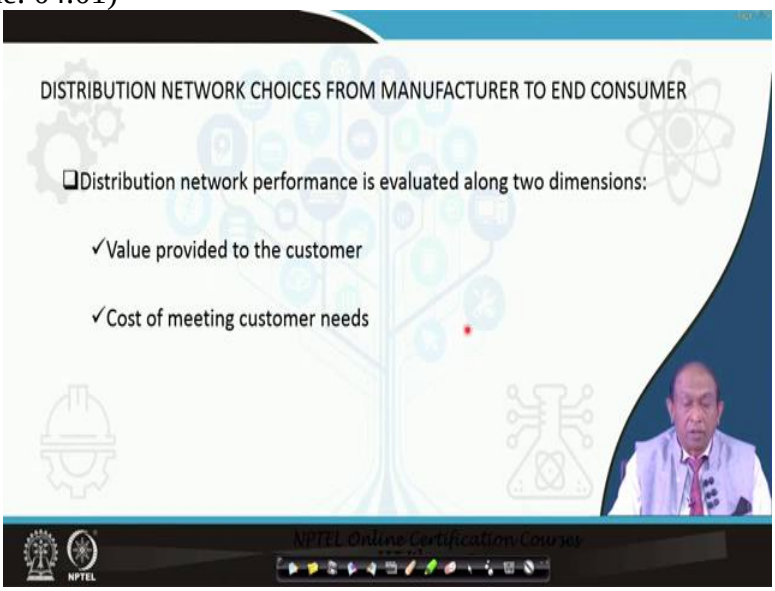

And since we will be illustrating you some of the performance characteristic the distribution network performance is mainly evaluated along two dimensions. One is value provided to the customer and the cost of meeting customer needs.

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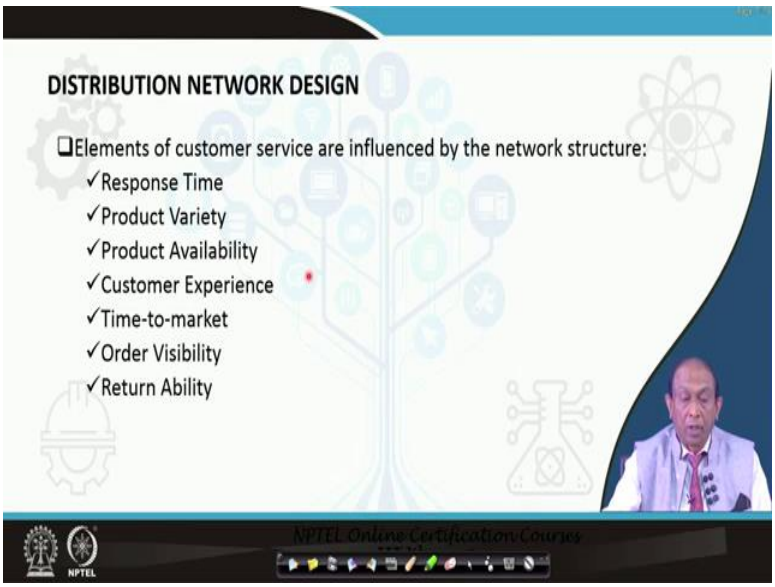

So first let us try to recapitulate what are those elements in customer service that are influenced by the network structure. Namely they are the response time, the product variety, product availability, customer experience, time to market particularly for new products this

time to market is the total time that elapses between conceiving a product till it is launched into the market and if this time to market is short then you can be a leader in introducing new products in the market.

You can set the standards. You can enjoy market share much higher compared to anybody else till the point in time the competitors catches up with you and also your profit margin will be very high and you can enjoy it for a long period of time till others catches with up. Then order visibility and return ability. So these are the main elements which gets influenced by the structure of a network.

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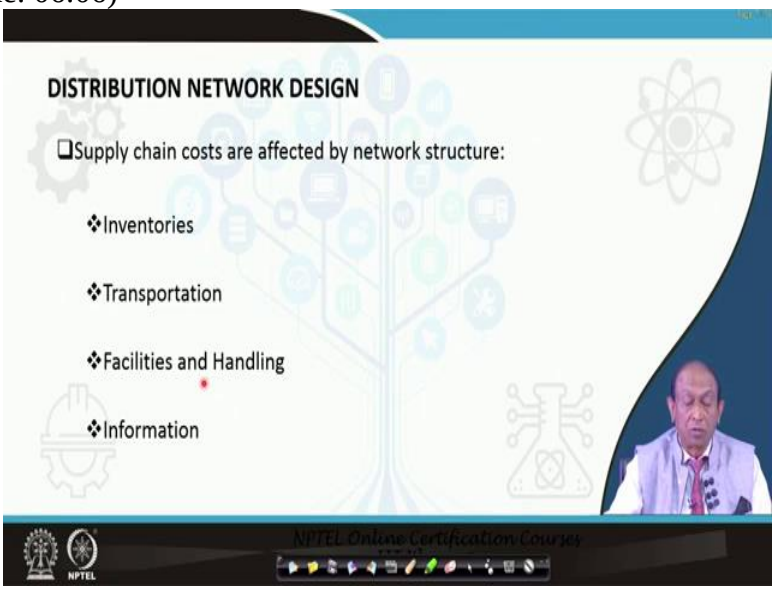

And supply chain cost which are affected by network structure include cost of holding the inventories, the amount of inventories that you carry at each of these nodes, the transportation cost, the cost arising out of maintaining the facilities, installing those facilities, maintaining them and handling of products and related services as well as one main element of cost is the cost of information network, information processing. All this thing are mainly influenced by the type of network structure that we put in place.

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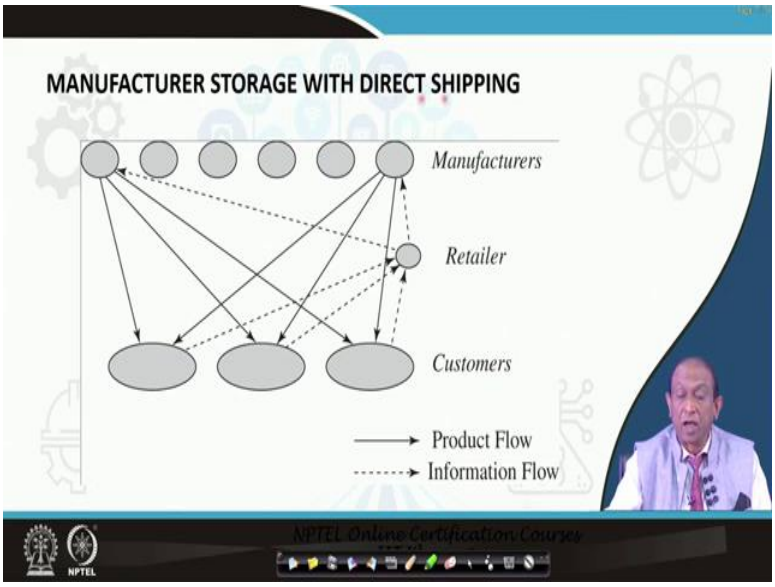

We start with the first design configuration that is the manufacturer storage with direct shipping. Do you see these are all manufacturer and the customers are here. So customers they place order on to retailers and the retailers they communicate this orders on to manufacturers. The manufacturers in turn directly ship the products on to the customers, bypassing the retailer. So here products flow directly from the manufacturers end to the customers end bypassing the retailer.

Here the role of retailer is basically to receive orders from customers and to communicate those orders on to the manufacturers and to co-ordinate the flow of those orders because the customers will ask the retailers about the status of those orders. So tracking the status of orders also depend upon the amount of investment that has taken place on the information system structure in this kind of network. Because here the retailers have to co-ordinate with both manufacturers as well as customers. So cost of investment and the complexity that arises with the establishment of a good information structure is high.

Now let us see with respect to other things what are the advantages, what are the disadvantages. What are the main characteristics of performance when we basically look at manufacturer storage with direct shipping.

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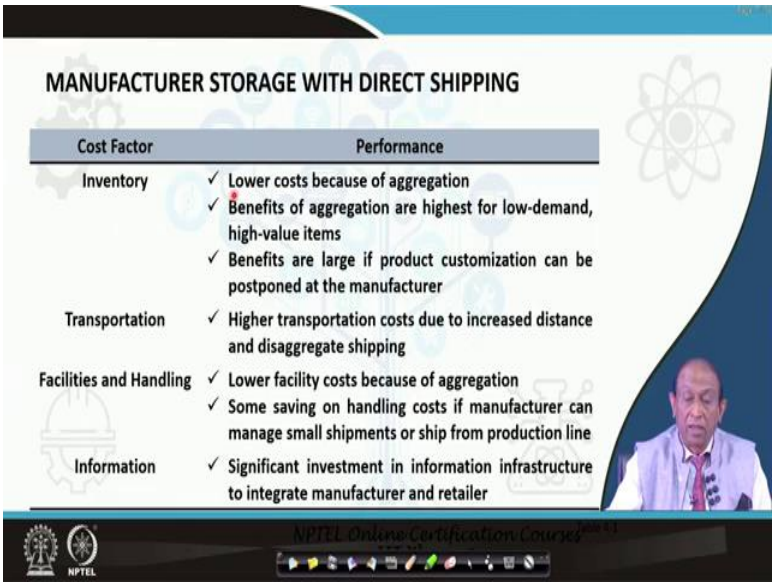

Inventory holding cost in such a network is low because the products are directly sent from the manufacturer ends to the customer's end, lots of aggregation takes place. Because everything that entire inventories accumulated at the manufacturer end.

So due to this aggregation the, there are plenty of benefits including even the forecasting of demand which is much more accurate when you are basically trying to forecast aggregate demand and this benefits of aggregation primary thing, primary point is that you need to carry less amount of inventory if you aggregate the products.

The benefits of this aggregation then are highest for low demand but high value items and since the products are being disposed, are being sent from the manufacturer end to the customers end the final assembly at times is done at the customers end because if an order consists multiple products the final assembly may be done at the customer end by the customer himself.

So benefits are large if product customization can be postponed at the manufacturers end because you know, the final assembly is getting done at the customer end. So you do not need to carry the finished product at the manufacturer end. Transportation costs are high due to increased distance and disaggregate shipping because one product is coming from one manufacturer another product is coming from another manufacturer and the total assembly is taking place at the customers end.

So there maybe disaggregate shipping and all these products may not reach the customers end at the same point in time. So sequencing of these arrival of parts is a very important thing and the customers experience some what is not very good in terms of you know waiting for some products to appear come much later.

So the advantage that the customer gets cause the… you know it is basically home delivery. The material or the product is being sent to his home or to his location. So there by customer need not bother about you know picking up the material and if it is a bulky product then you know he gets lot of advantage. But that advantage or that experience is somewhat gets you know is some what affected if the customer, do not find all the products being delivered to him within a reasonable point in time.

Facilities and handling cost if you look at it lower facility cost because of aggregation. You do not have to you know store inventory or stock of material in warehouses or intermediate nodes. Intermediate stores you do not have to create and that there by the facility costs are lower and there as, there is some saving on the handling cost if the manufacturer can manage small shipments or ship directly from the production line.

Normally what is happening from the production line the manufacture will basically store the products in large packs in his warehouses and sometimes when the order comes in they have to bulk, break this bulk and then make a package separate package for a single item or single product and send it to the customer.

So handling cost are pretty high in this case because on one hand you are storing it in the warehouse in large packs and then when the order is received you are dismantling or you know you are breaking that large pack and packing it up with one or two items that are being sent along with the order to the customer. So handling costs are high. But this saving can be done on the, this handling cost if the manufacturer can send small shipments directly from the production line. Significant I had already mentioned significant investment in information infrastructure is required to integrate both manufacturer and retailer.

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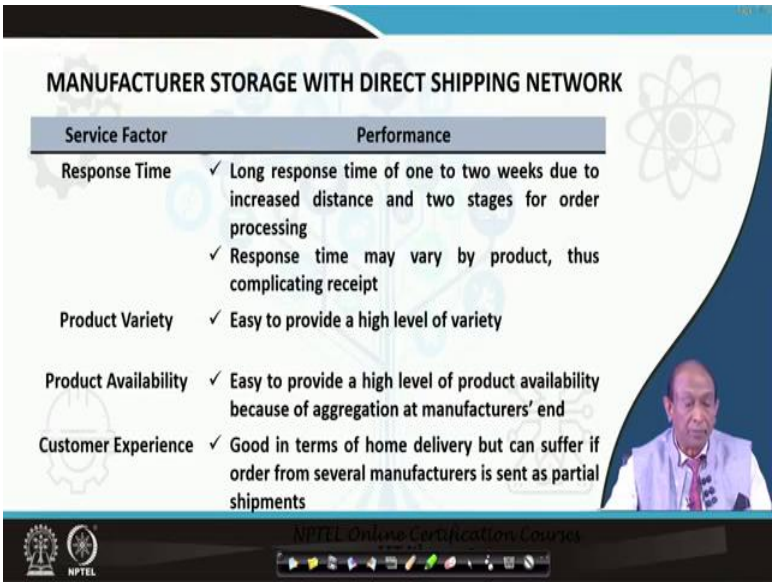

Response time long response time of 1 to 2 weeks mainly due to the increased distance and two stages for order processing. Customer is placing the order on to the retailer. Retailer is again communicating that order on to the manufacturer and the manufacturer is sending from his end to the customer. The distance is pretty may be high or long and due to that the response time maybe more than 2 weeks also at times and this response time may vary depending on the product thus complicating receipt.

Product variety if you look at this particular service factor. It is easy to provide a very high level of product variety because it is coming directly from the manufacturer's end. Product availability easy to provide a high level of product availability because the entire all this products are aggregated at the manufacturer's end. Customer experience good, in terms of home delivery, but can suffer if order from several manufacturers is send as partial shipments.

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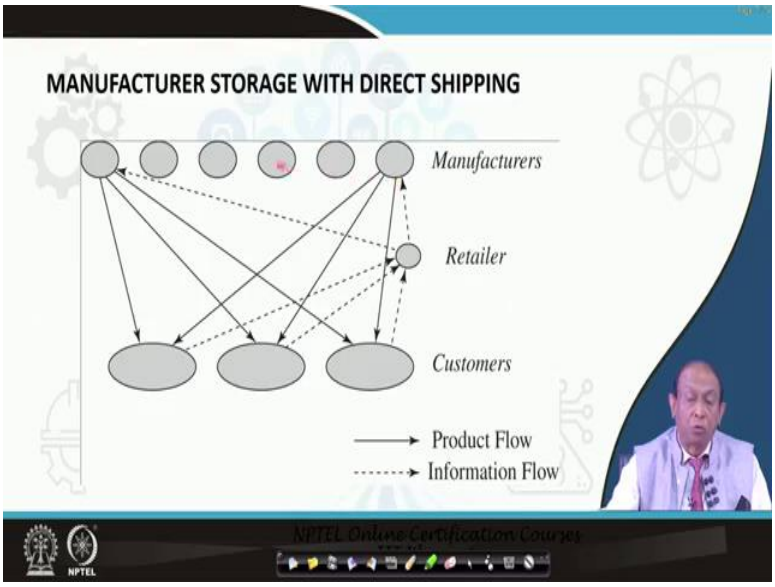

So see if you look at this picture again. if the number of sources or the manufacturer's in here is less then it becomes quite applicable but if the number of sources from where the different types of items they are being sent to this customer's end if that is high then this kind of network is not a very pleasing thing for the customer because he has to wait for you know products being sent from you know different manufacturing end on to his site.

Typically say you look at when Dell was processing directly the customer orders at that time see from one particular the PC can be obtained from the Dell's factory itself and the monitors can be obtained from Sony and they can be assembled at the customer's end.

So if there are one or two manufacturers or two or three manufacturers then it is a good experience for the customer and these are quite feasible option this kind of configuration. But if the number of manufacturers from where products have to be sent is high and then assembled at this particular stage at the customer's end then it becomes somewhat not a good experience for the customer.

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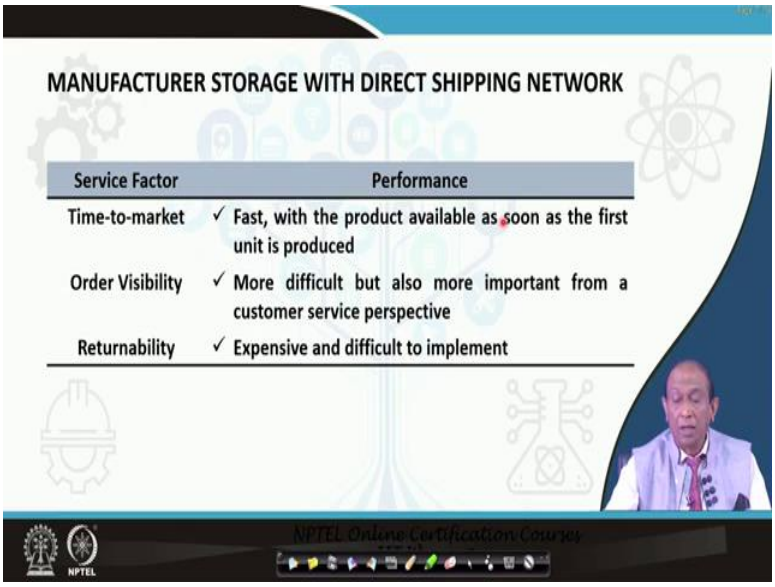

Time-to-market first, with the product available as soon as the first unit is produced. Order visibility more difficult but also more important from a customer service perspective. Return ability is expensive and difficult to implement.

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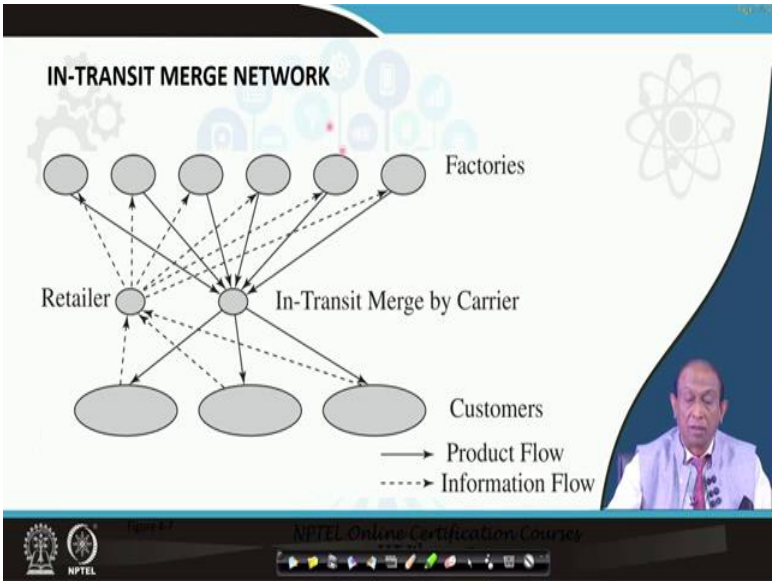

Let us look at in-transit merge network. See in this you see the different factories here. The customers are here. Customers are placing their orders on to the retailers. The retailers are communicating this order information to different manufacturers at their factories depending on the type of product which is to be sourced from the particular factory.

Now what is happening upon receipt of this order information from the retailers this manufacturers or from the factories the materials are being sent to an intermediate warehouse or a distributor where these products are merged together by a third party carrier and then shipped on to the customers. So this is basically calling this is called in-transit merge by carrier a third party carrier or even it maybe this carrier may be owned by the retailers.

So they are basically receiving different products from different customers. They are merging all these products and the consolidated shipment takes place from this end and sent to the customers. This is basically in-transit merge by carrier because the entire different products in an order are merged together in-transit by the carrier.

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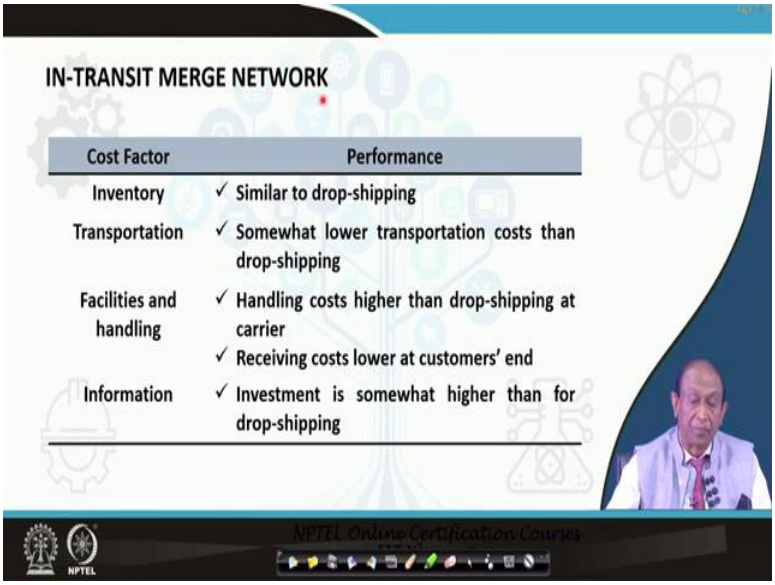

So let us look at the different advantages or the characteristics or the performance of this particular type of configuration. If you look at the cost factor, inventory if you see it is similar to drop-shipping.

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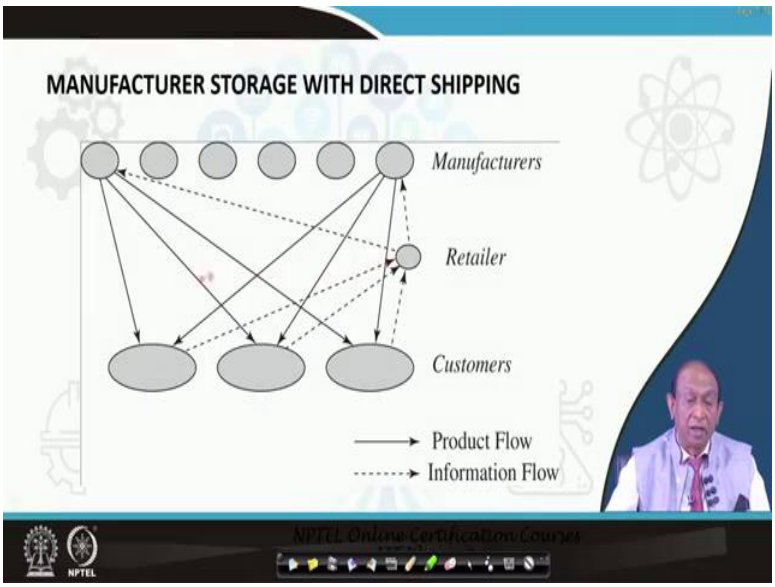

Incidentally I forgot to mention that the first network structure that we had seen that is manufacturer storage with direct shipping. This is basically also called drop shipment or drop-shipping you have manufacturers from the manufacturer directly onto the customer the shipment is dropped. So it is also very popularly known as drop-shipping or drop shipment.

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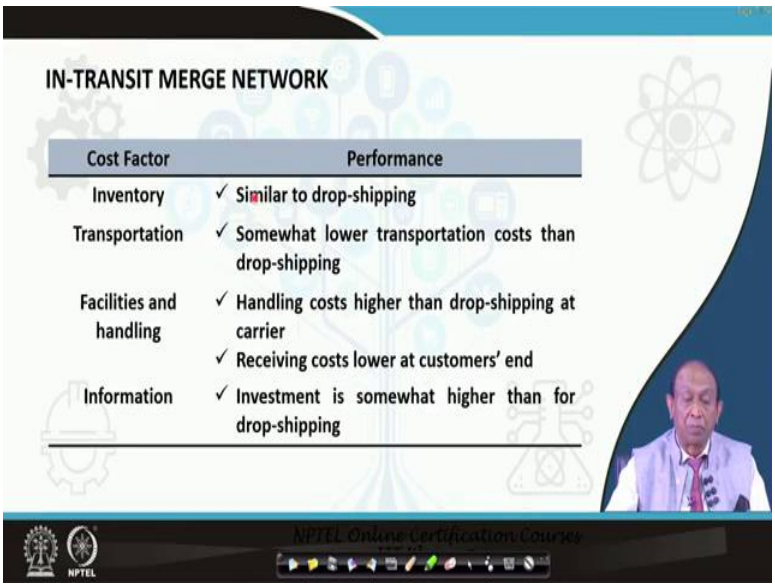

So when we are trying to compare the in-transit merge network with drop shipment then we find that with respect to inventory the performance is similar to drop shipment. Transportation is somewhat lower transportation cost than drop-shipping because you are consolidating the orders or the products from different manufacturers at an intermediate

point. You are merging over there and then you are basically sending it to different customers and thereby the cost of transportation can be lower somewhat lower.

Facilities and handling cost hearing the handling cost is higher than drop shipment because the carrier at the transit point in is merging the different products from different manufacturers to the handling cost is very high compared because there is a previously the customer was doing the all the assembly and all the merging and everything but here the it is done by the carrier.

The receiving cost is lower at the customer's end because customers you know they are not bothered about when the products from different manufacturers will come and all he is getting the consolidated products or the shipment is in a consolidated manner. Information investment is somewhat higher than for drop shipment because here there are plenty of coordination that needs to be done compared to the earlier stage.

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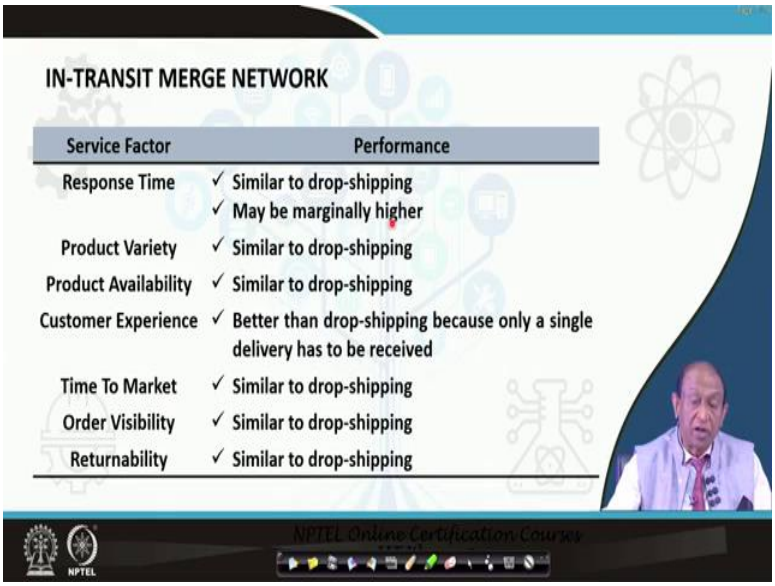

Response time similar to drop shipment maybe marginally higher because that in-transit merging will also take some time. Product variety similar to drop-shipping. Product availability similar to drop-shipment. Customer experience better than drop-shipping because only a single delivery has to be received and the customer may not be at a time bothered about assembling and other things so because entire thing is being merged by the carrier and consolidated shipment is coming the assembly is being done by the carrier so customer need

not be bothered about it. Time to market similar to drop shipment. Order visibility and Returnability is also similar to drop shipment.

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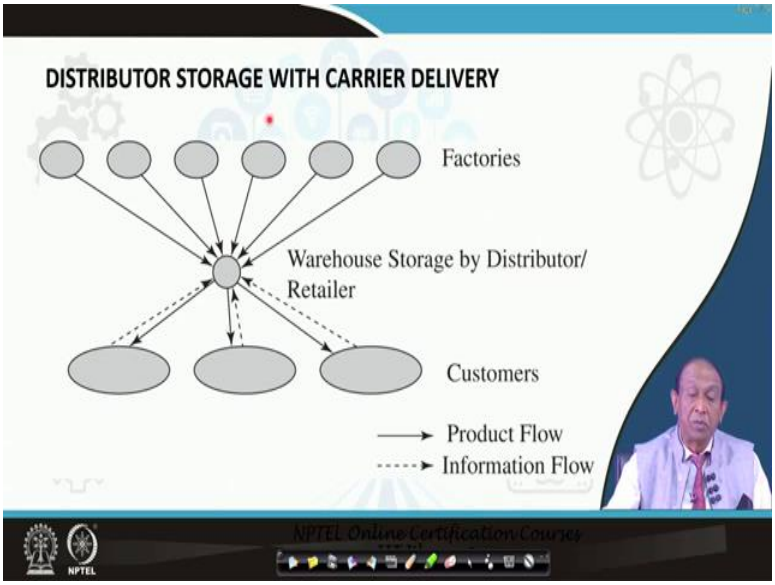

Let us look out look at the distributor storage with carrier delivery. Here you see there is a warehouse storage and this warehouse storage warehouse maybe basically owned by the distributor or the retailer and the products are being sent by the distributed from the storage on to different customers. The customers they are placing the orders on to the retailers and the product flow and information flow I have illustrated in this particular diagram.

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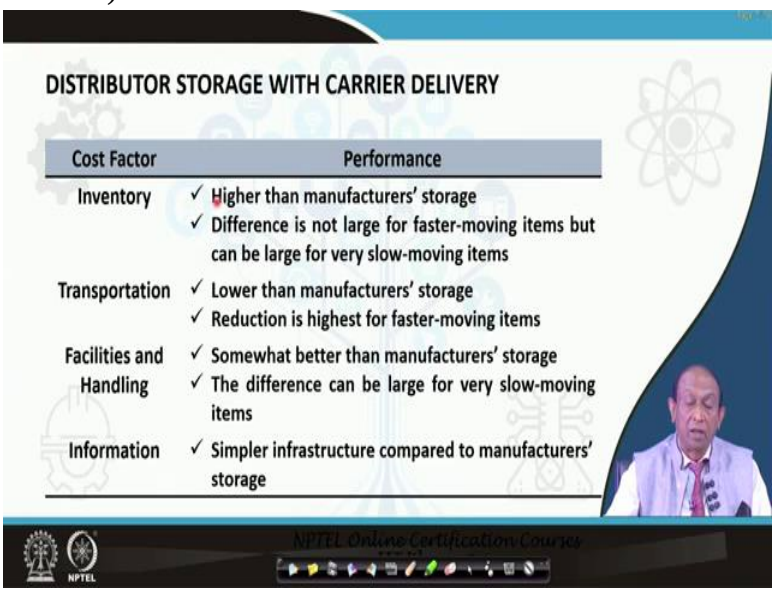

Here if you look at inventory. The inventory carrying cost is higher than manufacturer storage Difference is not large for fast moving items but can be very large for very slow moving items. Transportation cost lower than manufacturers storage and their reduction is highest for fast moving item because this kind of network is mainly applicable for first moving items.

Facilities and handling cost somewhat better than manufacturer storage the difference can be large for very slow moving items and information simpler infrastructure compared to manufacturer storage.

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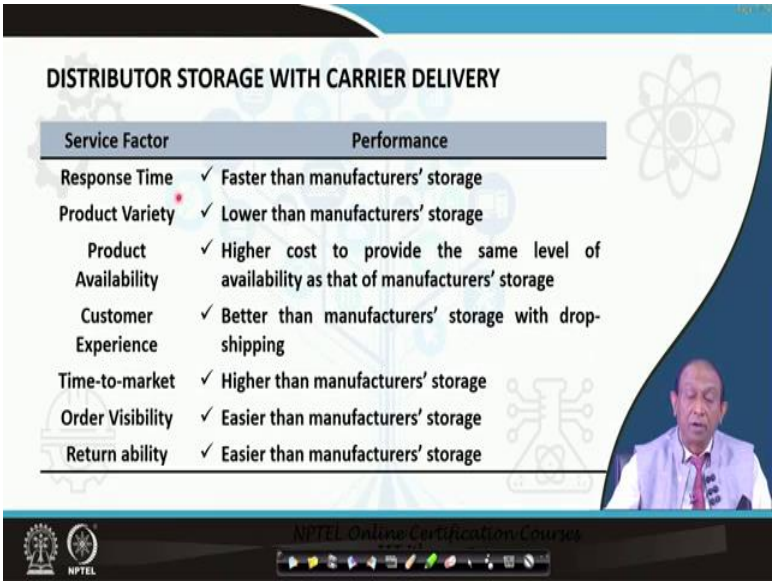

Response time faster than drop shipment. Product variety lower than drop shipment. Product availability here we need to incur higher cost to provide the same level of availability compared to drop shipment. Customer experience better than drop shipment. Time-to-market higher than the drop shipment. Order visibility easier then drop shipment and Returnability is also easier and much more convenient compared to a drop shipment situation.

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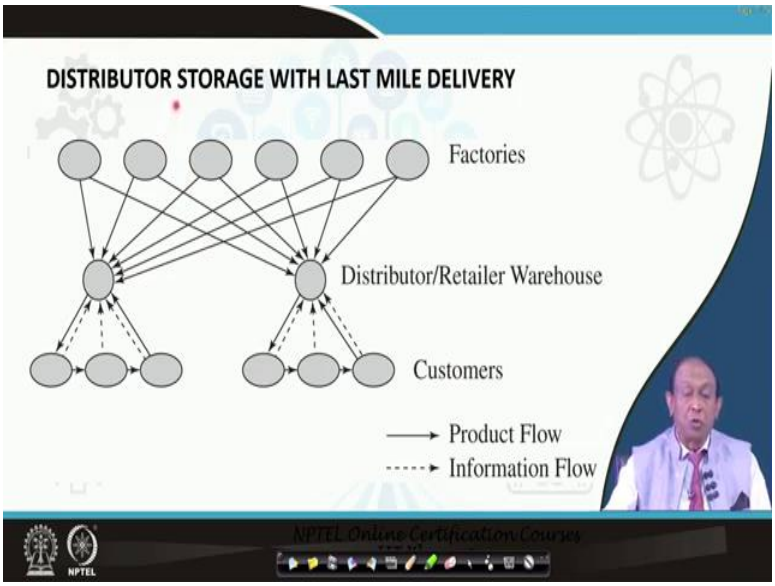

Distributor storage with last Mile delivery. See here last Mile refers to customers, basically they are placing the order on to different distributors or retailer and this distributor they are basically sending it to the customers.

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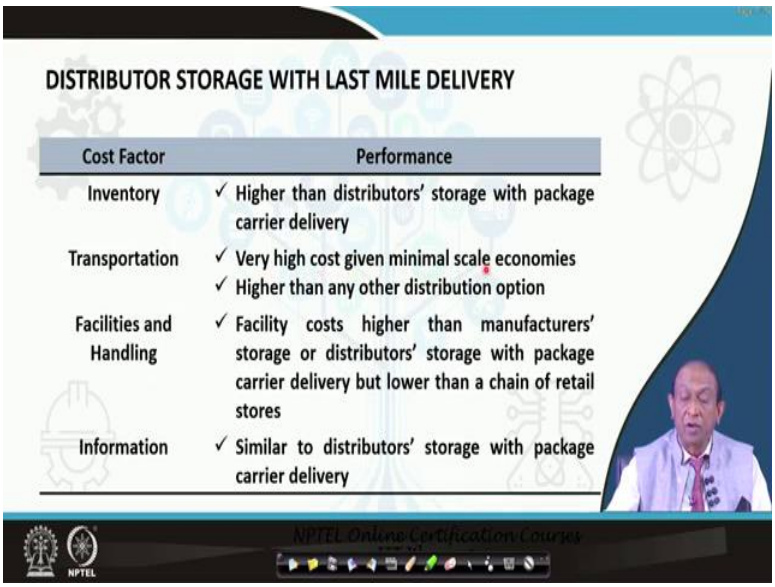

So here you see the advantages in terms of inventory higher than distributed storage with package carrier delivery. Transportation cost is very high given minimal scale economies. Higher than any other distribution options. Facilities and handling cost are higher than drop shipment of distributed storage with package carrier delivery but lower than a chain of retail

stores. Information cost of information processing similar to distributor storage with package carrier delivery.

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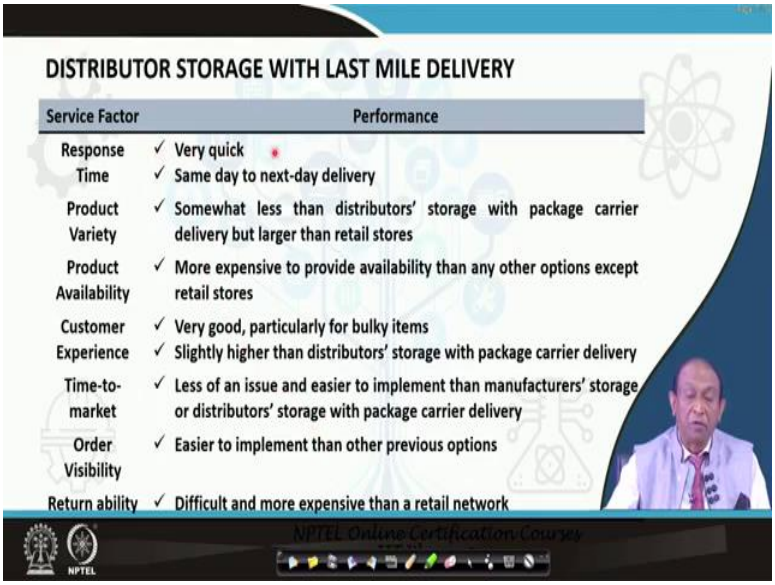

Response time very quick maybe same day to next day delivery. Product variety somewhat less than distributors' storage with package carrier delivery but larger than retail stores. Product availability more expensive to provide availability than any other options except retail stores. Customer experience normally is very good and for particularly for bulky items it is very convenient for the customer because it is being sent to his home. Experience slightly higher than distributors' storage with package carrier delivery.

Time to market less of an issue and easier to implement then manufacturers' storage of distributors' storage with package carrier delivery. Order visibility easier to implement than other previous options. Returnability difficult and more expensive than a retail network.

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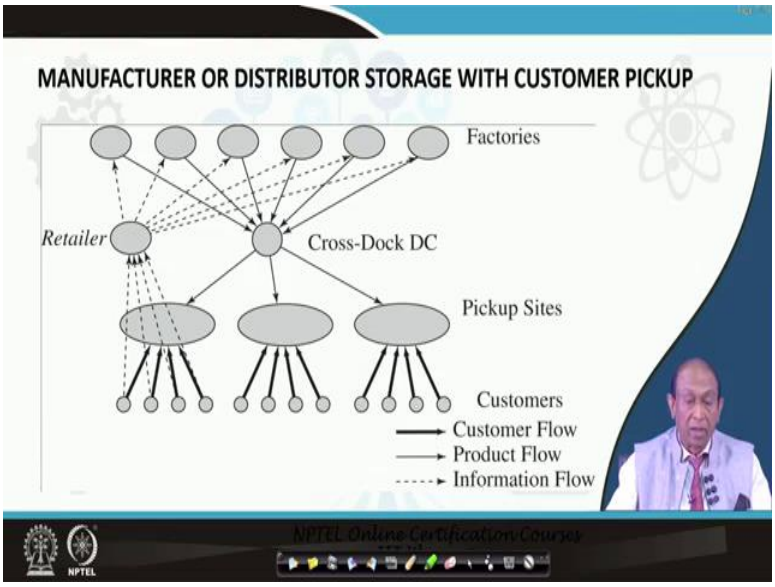

And manufacture of distributor storage with customer pickup is almost similar. But here customers they are going to a prearranged pickup site and collecting the material. So and the cross-docking is taking place in this intermediate location. Products from different factories are coming you know and then they are being transported through small trucks and with particular meant for specific customers. So cross-docking is a very important criteria.

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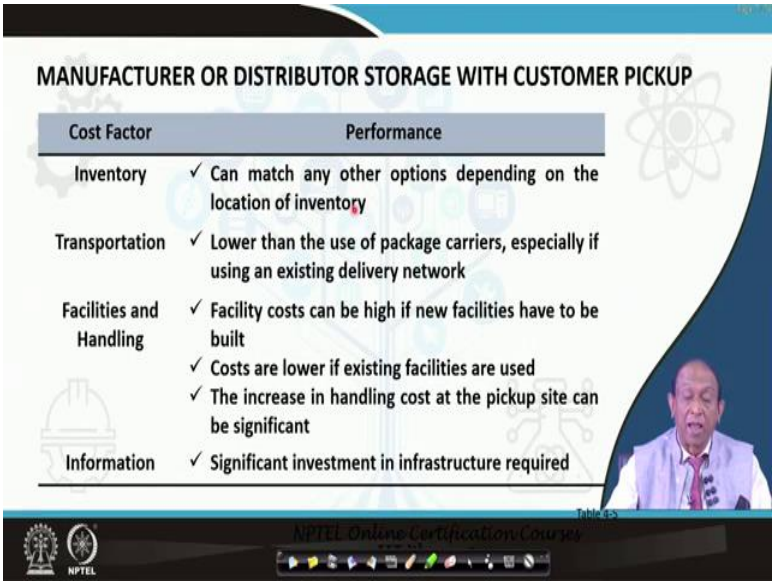

Here the inventory cost can match any other options depending on the location of inventory. Transportation cost lower than the use of package carriers. Facilities and handling cost can be high if new facilities have to be built. Cost are lower if existing facilities are used. Increase in

handling cost at the pickup site can be significant and information structure investment significant investment in infrastructure is required.

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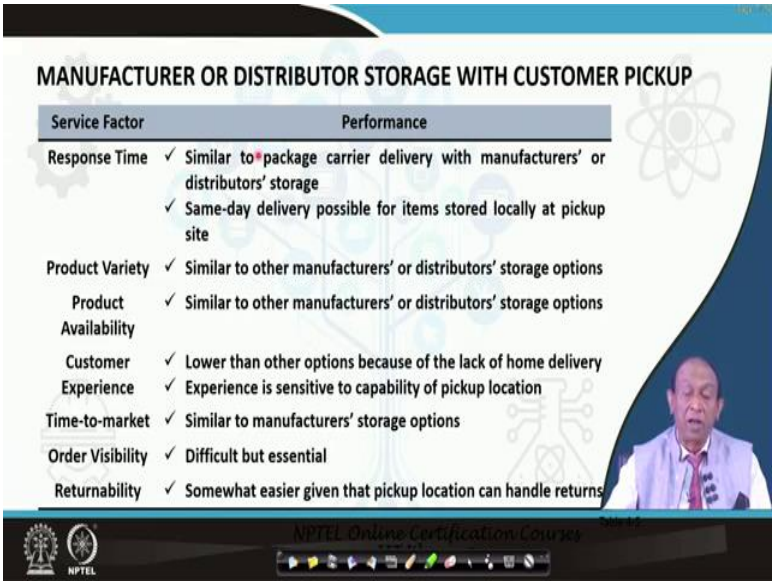

Response time similar to package carrier delivery with manufacturers or distributor storage. Response time same day delivery possible for items stored locally at pickup site. Product variety similar to other manufacturers of distributor storage options. Product availability is also same. Customer experience lower than other options because of the lack of home delivery where here customers is going and picking up the material customer pickup. .

Then experience is sensitive to capability of pickup location. If the pickup location is far away then they know the customer might get some what displeased. Time-to-market similar to manufacturer's storage options like drop shipment all is not much of variation. Order visibility difficult but essential. Returnability somewhat easier given that pickup location can handle returns.

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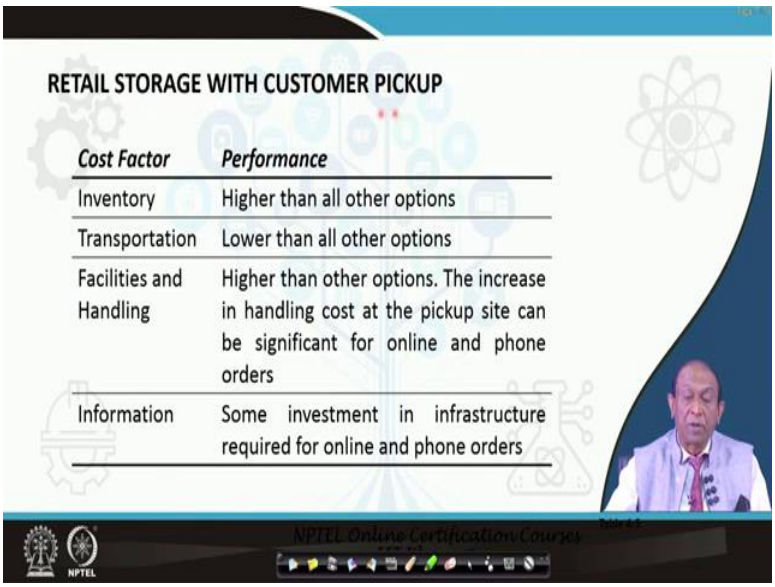

Retail storage with customer pick up. This is the last configuration network last network configuration. Here in customers they are picking up from the retail locations, the retailers they are basically storing the products. In here inventory cost is higher than all other options because the retailer has to carry all the items and stock.

Transportation lower than all other options because if there are plenty of retailer customer can directly go or place orders online and pick up. Facilities and handling cost higher than other options the increase in handling cost of the pickup side can be significant for online and phone orders. Information some investment in infrastructure required for online and phone order otherwise it is almost same.

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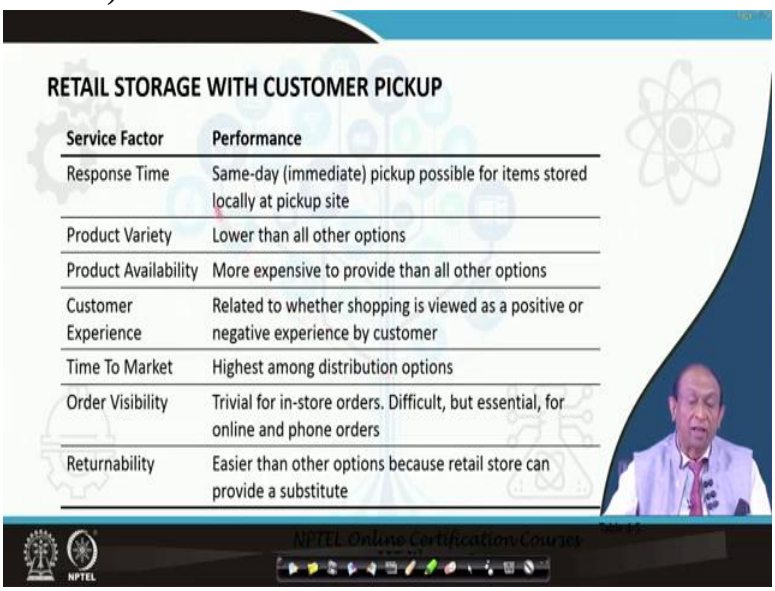

And the other characteristics of Response time same day pickup possible for items stored locally at pickup site. Product variety lower than all other options. Product availability more expensive to provide than all other options. Customer experience related to whether shopping is viewed as a positive or negative experienced by customer. Time-to-market highest among distribution options. Order visibility trivial for in-store orders difficult but essential for online and phone orders. Returnability is easier than other option because retail store can provide a substitute.

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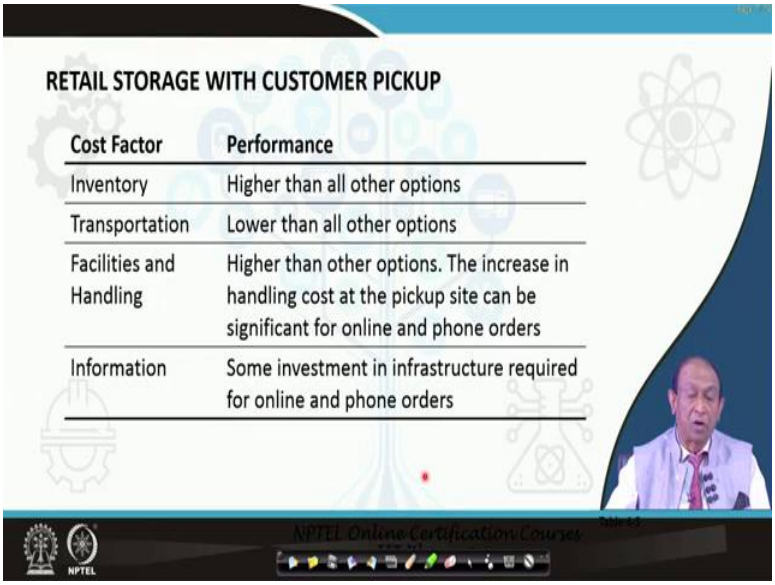

So quickly I have elaborated on some of the performance characteristics associated with retail storage with customer pickup. But there are plenty of literature and text books which will deal in detail with this design configuration. If you are interested you can look into all this.

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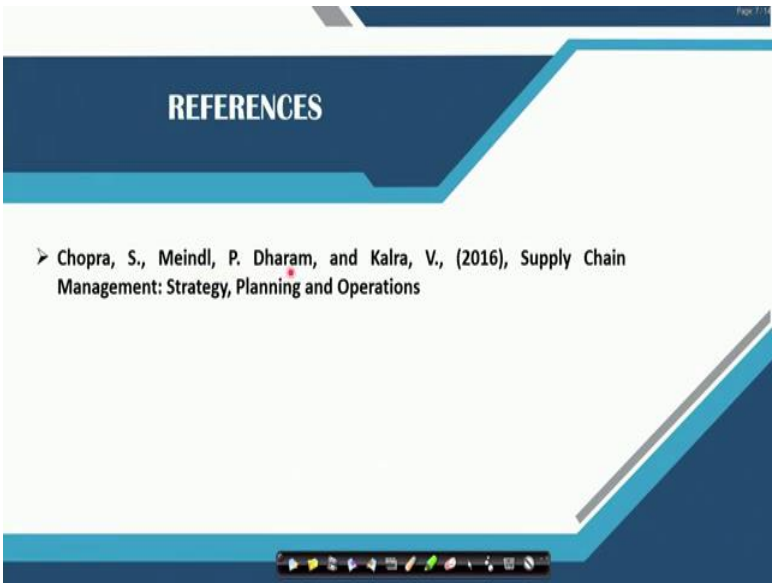

But little bit of knowledge is required for application of analytics we have delt in particularly you can refer to the book Chopra Meindl Chopra and Meindl as well as Dharam and Kalra this particular book deals in detail about this particular topic thank you.