Supply Chain Analytics
Prof. Dr. Rajat Agrawal
Department of Management Studies
Indian Institute of Technology-Roorkee

Lecture-03
Analytics in Supply Chain Management

Welcome back. We already have 2 lectures on this topic of supply chain analytics. The first lecture helped us to understand the basic principles of supply chain management. We discussed the importance of supply chain in the current business scenario. And in the second lecture we started that how supply chain has evolved over 100 years and then we also discuss the use of analytics in supply chain decision making.

That what are the current challenges of supply chain management and how analytics can be very handy for improving those challenges to solve those challenges and in todays discussion we will further like to elaborate on those very aspects of using data, using data driven decision making for the supply chain decisions or various levels of supply chain. Just to re-capsulate whatever we have discussed in our earlier 2 lectures.

We discussed that supply chain is thoughts from vendors on one side then there is a manufacturer and then you have distribution till consumer uses those product. And we also emphasised that now a days it is more supply network and supply wave, these type of terms are more popular, the reason being when we talk of chain it is more like a linear phenomena, but when we see that at each stage of chain there are so many entities which are involved.

And therefore, it is more appropriate to say that it is now supply network of supply wave. And now moving further into the discussion that we discussed about the initial idea of supply chain which is started from Ford motor company, which used to control the mining of iron ore on one side and distribution of finished car on the other side. So very integrated supply chain was conceptualized by Ford motor company.

And because of the high level of integration the supply chain was very efficient, but at the same time the problem was lack of flexibility. As we discussed in our second lecture that it is more popular with the name of supply chain sub line only black and T model of cars. Then

we discussed about Toyota concept, where Toyota developed a pool of vendors. And it started incorporating flexibility into the supply chain.

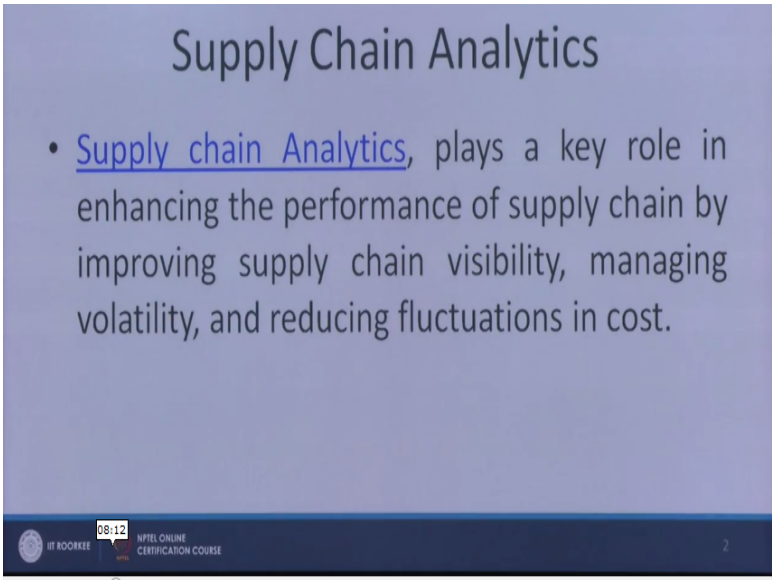
And over a period of time most of other industries maybe electronics, maybe consumer durables, maybe even FMCGs. All these types of industrial segments is started adopting Toyota model of supply chain. Late in the 20th century or in the beginning of 21st century we have this IT revolution and as a result of this IT revolution we have another very important revolution in the development of supply chain phenomena.

And this model is characterised as we discuss with the name of Dell company. The Dell used power of information technology for delivering their products in a highly customized fashion and this model of supply chain became very popular model because of competition, because of increasing expectations of the customer. Now we need a very specified customized products. And through the power of IT Dell was able to deliver a high degree of customized products to its customer.

So that is the latest phenomena. Now in last 2 decades there are very rapid changes which are happening in the business environment and at the same time there are rapid changes which are happening in the technological environment also. When I am talking of technological so my focus is more on the information technology. And now the current wave of supply chain development is integrating both these things.

It is integrating the development of supply chain management as a concept, as a theory, as a practice and on the other side it is taking care of development of information technology, data management techniques and now the supply chain analytics will provide a very good platform where we are going to use both these technologies, both these concepts for solving some of the challenges which we discussed in our lecture number 2.

(Refer Slide Time: 05:50)



We will like to re-capsulate all those challenges in todays lecture also. So just to give you these memories of whatever we discussed in lecture number 2 regarding supply chain analytics. So supply chain analytics plays a very key role in enhancing the performance of supply chain by improving supply chain visibility, you see these 3 important activities we expect from supply chain analytics.

One is the visibility, now the visibility is very important because of customer experience. There was a time when we use to send a letter in the post office and it was like a black box that you just put a letter whether it is registered letter in the post office and you do not know at what time your letter will be delivered to the receiver. But now a day you have a tracking number available with you.

And continuously on internet, on the given total you can put that tracking number to track the movement of that letter, that packet. Large number of courier companies are putting RF ID tax in the packets, so that the online movement of those packets can be tracked and accordingly customer is having a better experience about those products. At in variety of critical items like if I talk of disaster supply chain, if I talk of medicine, if I talk of some emergency equipments the supply chain visibility becomes very very important.

In almost all e-commerce sides whenever we purchase a product we get a total number, a document number and through that document number you can always see you can always have this visibility component satisfied that where is the location of your order number. So

this supply chain visibility is a very very new and interesting area to give you a better customer experience.

The second is volatility, managing unprecedented changes in the supply chain. And for that propose the supply chain of previous years supply chain of whole time may not be suitable in present context. So with it more flexible supply chains to handle issues like volatility. And flexibility can be provided with the tools like supply chain analytics. So we will see that how real time data availability can help us to inculcate more flexibility into the supply chain.

That is what we mean with managing these disruptions. And then reducing fluctuations in the cost. Yesterday in our lecture number 2 we discussed that there are issues related to frequent stock outs or issues related to access inventories in this supply chain. All these things create fluctuations in the cost of offering a product to the customer. If I go for the sake of flexibility too much changes of my production system.

All these things will lead to fluctuations in the cost. So I suddenly need to be very careful that there should not be too much fluctuations in the cost because ultimately if there is too much fluctuations in the cost I cannot have a good idea about the profitability of my overall supply chain. So these 3 important issues are there which we will like to develop with the help of supply chain analytics.

(Refer Slide Time: 10:09)

So visibility of global supply chain and logistic processes that is certainly one area which we will like to work on. The second is to manage the demand flexibility as we discussed

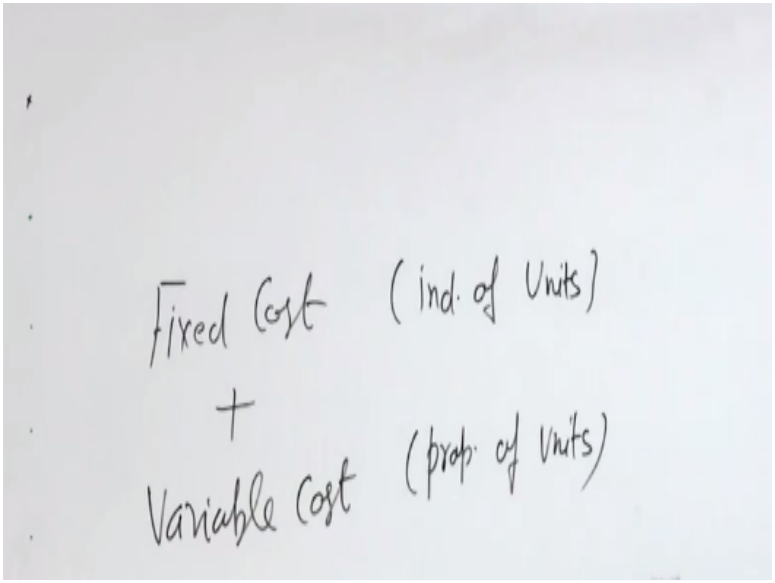
yesterday also. So we need to manage the demand with respect to varieties also. New type of products, more designs, more variations are required by the customer and at the same time you do not know what quantities a customer may require all of sudden.

Some time in some products like if I talk of salt, so you have a very steady demand pattern of salt. When apple launches iphone7, so apple does not have any idea that on day 1 what will be the demand of this iphone7. So handling products like iphone7 verses handling products like a routine salt requires 2 different types of supply chain strategies and as you move towards new automobile products as move towards new electronic products as you move towards new type of consumer durables.

Because when we are discussing this supply chain analytics at the same time you all know that there is lot of emphasize on innovation. And when innovation is coming into the new product development this problem of demand uncertainty, this problem of demand uncertainty further increases and for that purpose our supply chain need to be very responsive if our supply chain is not responsive if our supply chain cannot provide immediate solutions.

For these changes in the demand probably we will be behind the race, we will not be able to compete with the most competitive organization. So this managing the changes in the demand, managing the fluctuations of the demand, that is also very very important. And third issue is how do we manage the fluctuations with respect to cost in the supply chain. There are 2 very important types of cost which we talk in supply chain anytime.

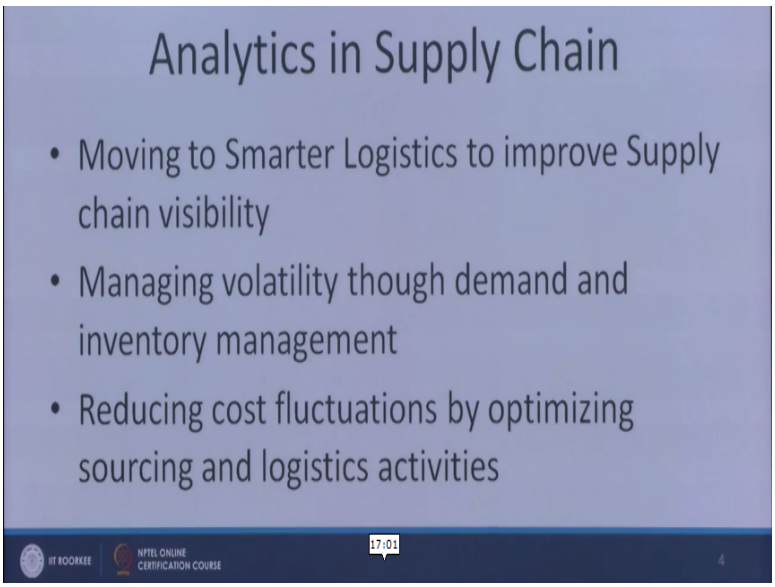
(Refer Slide Time: 12:48)



And these 2 types of cost include the fixed cost and then variable cost. In a supply chain we always try to minimize the combination of fixed and variable cost. You need to design, you need to develop your supply chain processes in such a fashion that you actually get finally the minimum fixed and variable cost. Fixed cost is that cost which is independent of units, that is independent of units and the variable cost is proportional of units.

So you need to do a proper exercise, you need to do a proper decision making, so that you have minimum of fixed and variable cost. And for that purpose again analytics will be a very handy tool that will help us to optimize the cost structure of a supply chain.

(Refer Slide Time: 14:10)



So these are 3 important issues and let us see that how analytics and supply chain will help us in addressing these 3 important issues of supply chain visibility, demand flexibility and reducing the cost of fluctuations in our supply chain. So let us see that first is we need to move to a smarter logistics to improve supply chain visibility. We need to move into the direction of a smarter logistics.

So far this term smarter was not there. So far in our logistic practice it is simply logistic for supply chain. We used to say in our conventional supply chain classes that we need to have a robust efficient, effective logistic systems for supply chain management. But now a days because we are talking of supply chain visibility, so we are moving towards a smarter logistics and for this purpose of a smarter what is the meaning of this smarter.

The meaning of smarter is where my supply chain can take decision on its own. I need to build that type of data, that type of sensors, that type of objective, that supply chain can take decisions on its own for improving the better visibility of my supply chain objects. So that component of developing the smarter logistic is related to date driven decision making and analytics will be directly related to make supply chain, a smarter supply chains.

Then second is to manage the uncertainty of demand. Now to manage the uncertainty of demand. The only solution available to us is to have a very effective efficient inventory management. But if it is not effective, if it is not efficient, so inventory management or inventory particularly can be a disaster also. In most of the supply chain we at the end of the day find that because of improper inventory management.

The cost of supply chain has increased tremendously and that weight of inventory has eaten up the entire profitability of your supply chain. So we need to find better ways of inventory management, which are leading to customer satisfaction because for the sake of good inventory management, if you are going for very less safety stocks then probably you can end up with stock out situations also.

So that is also not desirable. So for that purpose we need to have a smart inventory management where you can take decisions on inventory management on the real time databases. Realtime databases means normally we in a conventional follow P or Q type of inventory management either we have fixed period of remove that after every 1 week or every 2 week we are going to review the inventory position or we on a certain basis we have a fixed quantity of order and that keeps on going after reaching the reorder point.

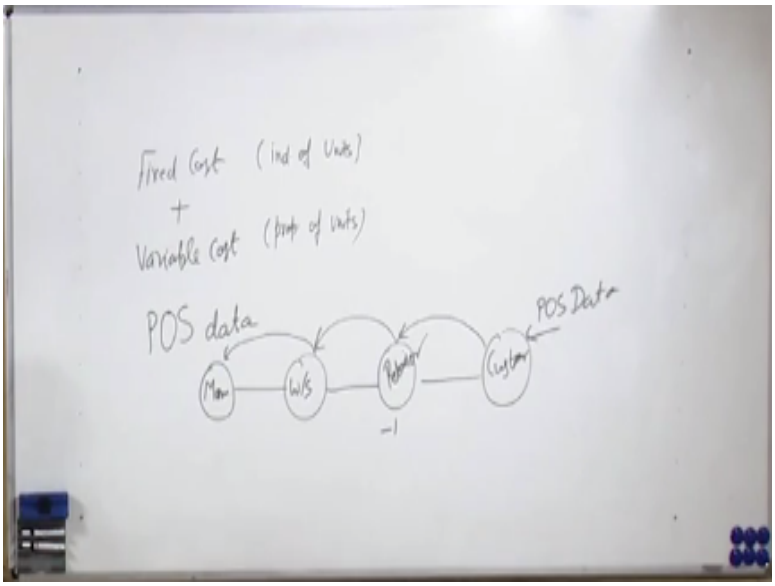
So whenever we reach that reorder point we give order of a fresh quantity, so that our stocks replenished. But in both these situations we are either facing the problem of stock outs or we are facing the problem of excess inventory. Both are not desirable and at the same time we are also facing the problem of this uncertainty in our demand particularly, so we need to have more real time data analysis for our inventory management.

And again analytics will be very much useful for achieving this objective of a real time inventory management where as soon as any item is taken away from your stocks. So that data is captured and that data is flown in the entire supply chain. So in our technical term we

say that point of sales data, POS. We now need to use this POS data for the purpose of inventory management.

Point of sales data and this point of sales data is available simultaneously at all stages of supply chain. The supply chain let us have a figure of that first.

(Refer Slide Time: 19:12)



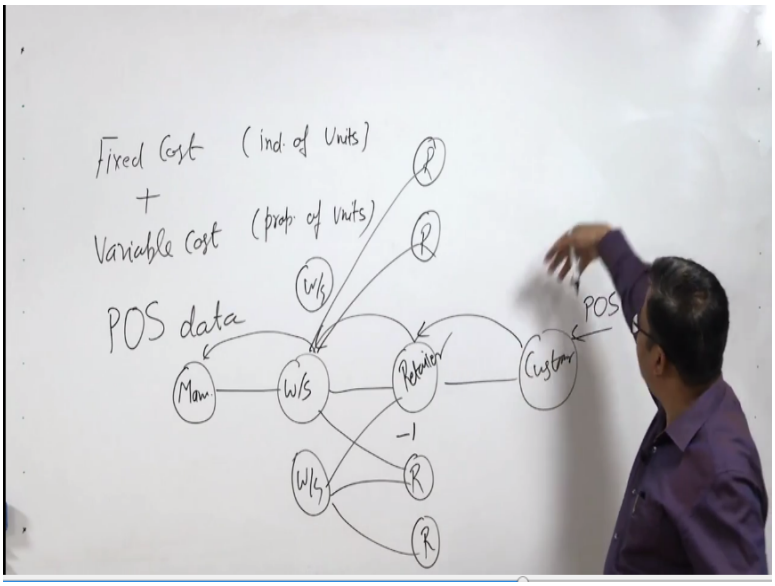
So here my customer is there and some sales is offering in the at the customer end, now this POS data is generated here and as soon as this data is generated at this customer end, the customer is going for the purchase at the retailer, so her picks up this product, so at this retailer inventory is subtracted by 1 unit. If he purchases 1 AC, 1 refrigerator, 1 colour television, 1 mobile.

So since all parties, retailer, wholesaler and manufacturer, all of them have an integrated systems and as soon as customer purchases product from the retailer, there is no need to communicate that information separately to wholesaler or to manufacturer. Because it is a continuous integration, so this data is immediately available to wholesaler and manufacturer. And on the basis of this information, basis of these types of data coming from different retailers and different wholesalers.

Each of these different entities can plan their inventory in the real time environment. So we want to have more you can say better inventory management is smarter inventory management with the help of this real time data analysis. So again that is all about analytics

that how do we do this real time data analysis. Then third is this reducing cost fluctuations, but optimizing sourcing and logistics activity.

(Refer Slide Time: 21:19)



Now you see there are various wholesalers, various retailers at different stages and products are flowing from wholesalers to retailers and with each retailer there are and number of customers also. Now we need to optimize again with the real time data that from which wholesaler, how many products will go to a particular retailer, from which manufacturing facility, how many products will go to a particular wholesale.

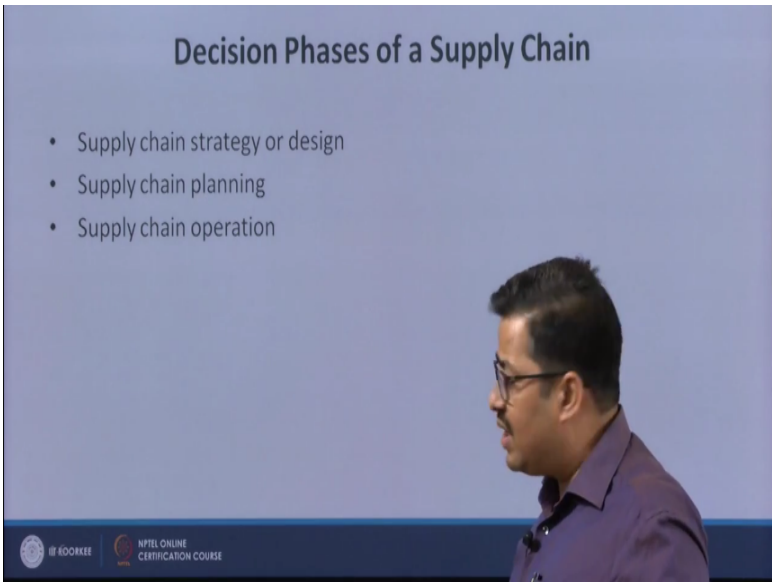
So that data which is available to us will help us to optimize our sourcing and transportation movement facility side related activities. So analytics will help us in reducing the cost related to sourcing and logistic activity. Because if we do not do this data driven exercises because we always need to keep this in mind that whenever we talking of analytics it is all about data driven analysis, it is data driven decision making, it is data driven implementation.

So everything is data driven, so all these activities which are most important for the present time, one is for the customer side supply chain visibility type of thing where customer is able to actually continuously track the movement of the packets, the products, and on the other side for the company who optimize the availability, who optimize the souring, who optimize the cost, and all those aspect.

So analytics will help us at all level of supply chain to achieve these 3 objectives. So with this now we are very clear I hope that what are the uses of analytics data driven decision making

in our supply chain. So once we are through with this now let us move to some more fundamental issues related to supply chain management.

(Refer Slide Time: 23:50)



Now in supply chain as we have discussed yesterday also that data are analytics a very important at all 3 levels. And 3 levels are you have the strategic level of supply chain where you design the entire supply chain, then the second level is the planning level, where you plan to implement the strategy and the third level is the operation where you actually execute those plans. So these are the 3 faces of the supply chain.

And the data analytics play important role in the strategic and the planning and at the operational level of the supply chain. Technical word is the another word which we use for the planning, so yesterday if you remember in the lecture we discussed the strategic technical and operational level. So technical and planning are used synonymously and we will be using these 2 terms interchangeable throughout this course. So now let us see what are the important activities in these 3 different faces.

(Refer Slide Time: 25:05)

So in the supply chain strategy, the designing face of the supply chain in that we take decisions about the structure of the supply chain. The generic supply chains which we discussed in our lecture 1, in that we have some very common type of supply chain designs, so which particular design is suitable for our type of organization, our type of product, our type of target market, that type of decisions are normally taken.

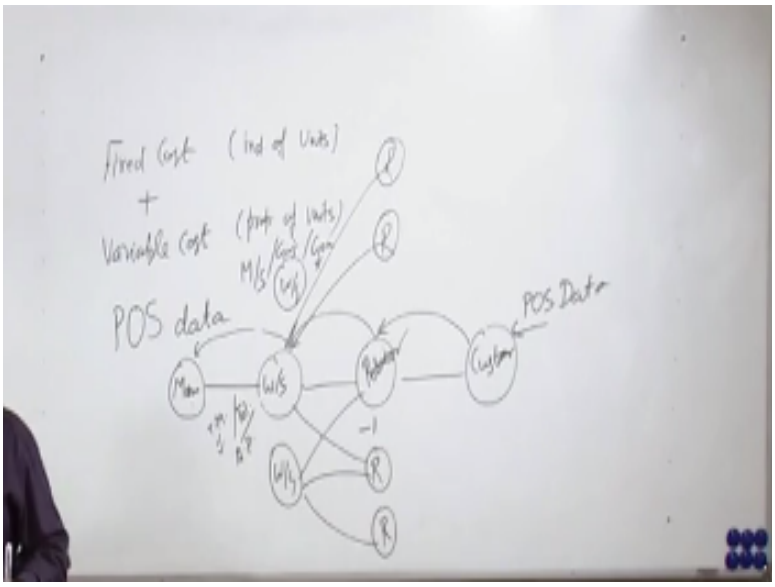
That type of choice of a structure is done in case of supply chain strategy, most important decision is how many intermediaries, we are going to have, whether there will be a retailer or not, whether there will be wholesaler or not, these type of decisions are normally the most important decision in case of supply chain strategy like we discussed yesterday.

The example of Dell where Dell earlier use to distribute their products through online system and it was Dell was directly dealing with the customer. So there was no intermediary between Dell company and the customer, no wholesaler, no retailer, but when Dell changes its supply chain so we use to say that Dell changed its supply chain strategy and it started using retailer in between.

So that is a type of strategic decisions that what is the structure of the supply chain, whether I want to have retailer, or I do not want to have retailer. These type of issues are the most important issues with respect to design of a supply chain and therefore these decisions are taken by the top of the organization. Those who are may be the board of directors, CEO, MD, CMD, these types of people they take the decision with respect to supply chain structure.

Then another important strategic decisions are the location and capacity of the facility. I want now I have decided that I want to have wholesaler, and retailers also in my supply chain.

(Refer Slide Time: 27:33)

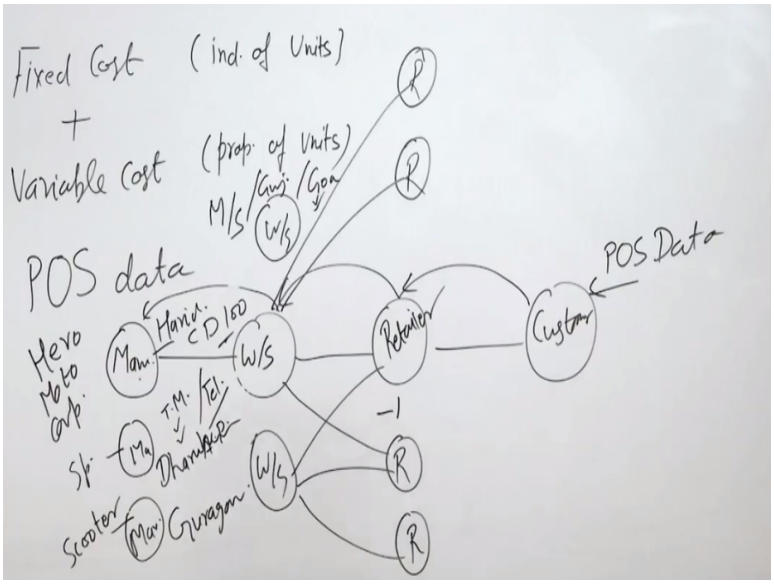


Now whether I want to have a wholesaler in Maharashtra or I want to have a wholesaler in Gujarat or I want to have a wholesaler in Goa, then another wholesaler I want in South India. So whether to have in Tamil Nadu, whether to have in Telangana, whether to have it in Andra Pradesh. So issues like that, so where these wholesalers will be and what will be the capacity of these may be all these wholesalers because of their further target market may not be of equal capacity.

So a wholesaler in Tamil Nadu may be much bigger than a wholesaler at Goa. Then it is noted not about only wholesalers, we take decisions because all these manufacturers, wholesalers, retailers, all of them are known as facilities. So I have to take decision about manufacturers also that where should I have my manufacturing facility, where should I have my wholesalers, where should I have my retailers, and what will be the side as I just discuss.

So location and capacities of the facility that is one type of decisions which are the part of my supply chain yesterday. Then second important strategic decision is about the products to be made or stored at various locations.

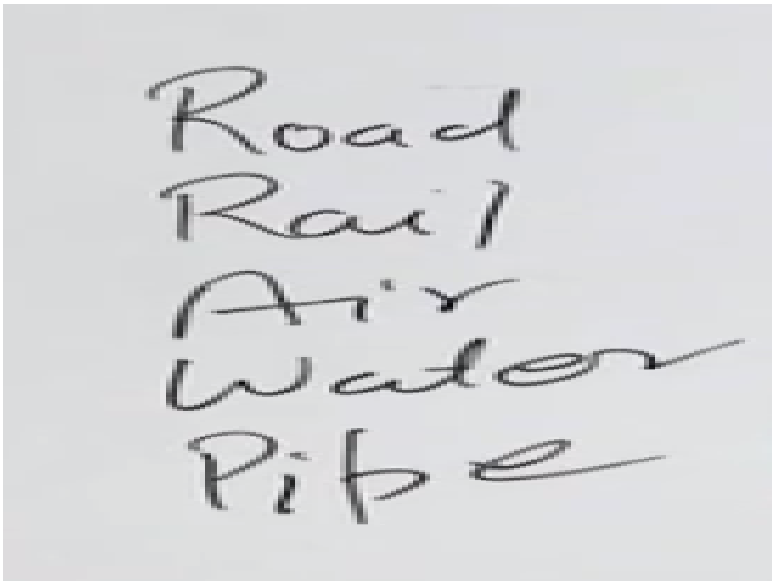
(Refer Slide Time: 29:09)



You have 3 manufacturing facility in the country, I have let say Hero Moto car and Hero Moto car and one of my facility is at Haridwar, 1 is at Dharuhera and another is at Gurgaon, which is Gurgaon now. Now I will decide that my Splender motor cycle will be made at my Dharuhera plant. My CD 100 motor cycle will be made at Haridwar plant, my scooter pleasure will be made at my Gurgaon plant.

So which product to be produced at which facility that is to be decided by again the strategic team of the organization. Then another important decision is the modes of transportation. Modes of transportation is another important decision which is again part of strategic decision. Just taking few minutes about modes of transportation. Mode of transportation may include lot of different types of modes are available and many times we may take decision about multimodal transportation also.

(Refer Slide Time: 30:50)



So the conventional systems are road, rail, air, water, pipe, these are our conventional **ah** systems conventional mode of transportation, but many times we may use a combination of mode of transportation you must have seen many time that road and rail are used together many times you have seen road and air are used together, many times you have seen that rail and water has been used together.

So you see that we have combination of different modes of transportation which are used to make the transportation system more effective and at the same time cost sensitive also. So what type of mode of transportation you want to use that is also a strategic decision. Then development of proper information systems for your organization. That is also a very important strategic decision.

You need to see that the information system should be robust and this information system should be able to handle the requirement of your supply chain system. So putting lot of emphasis on the information system because companies like Walmart, the success of these companies are basically attributed towards their information system. The investment, the continuous up gradation of their IS which company like Walmart are doing.

That is one of key component in the success of these organizations. So putting lot of emphasis on using the latest information systems, latest network across the supply chain is also very very important for the success of the supply chain and it is also a type of strategic design. So finally we can say that supply design must support the strategic objectives of your

organization. So strategic objectives of the organization can be supported only by the supply chain strategy.

And then supply chain design decisions are the long term decision and it is very expensive, it is very costly to change these decisions. So normally top management must be very very careful in selecting the supply chain strategies, supply chain structure, and all these things and as we have discussed that the current scenario is full of uncertainties, it is highly volatile and therefore it becomes very very important for us to design our supply chain in such a way which can take care of the modern requirement.

So we close this lecture at this point of supply chain strategy, the other 2 faces of supply chain decision making we will discuss in our lecture number 4. Thank you very much.