Principle of Industrial Engineering
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Lecture 48
Forecasting: Method

Hello, I welcome you all in this presentation relating with the subject Principles of Industrial Engineering and you know we are talking about the Forecasting, forecasting is about determining the possible demands for the various items like raw material, finished product, semi-finished products in advance through the use of qualitative and quantitative methods.

In case of the quantitative methods, the past demand data is utilized, while in case of the qualitative methods, the pulled thinking or the general observations of the experts or the salesmen are taken into account. So we will be going through the different methods which are used for forecasting.

In the previous presentation what we have seen is like the forecasting is a very important kind of the step in a smooth running of any business successfully.

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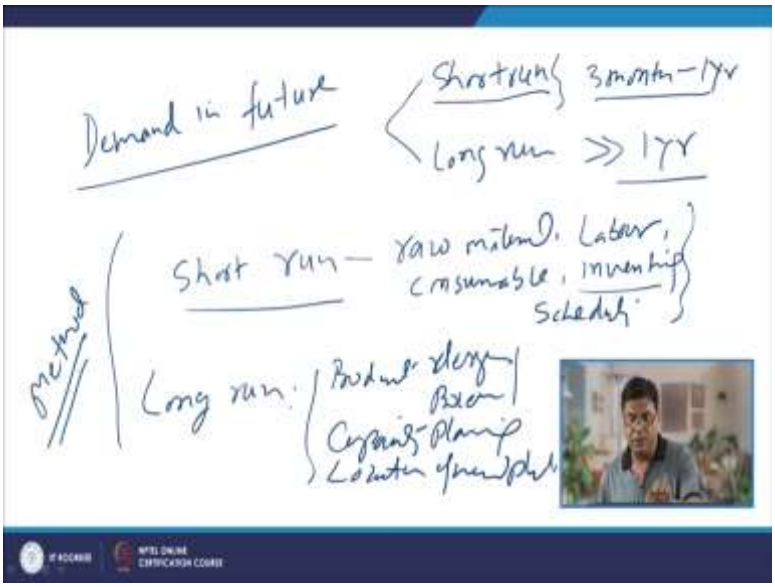

Because it helps in determining the possible demand in future. Now, how long future is means how far in future we are trying to look into that will be depending upon the objective of the forecasting, like as we have seen it can be the short run forecasting or long run forecasting.

Short run forecasting is for a shorter period, like say commonly it is up to period of t3 months, but it can be up to one year. While the periods or the time period from the current date to beyond the 3 months to normally it is beyond 3 months or it is greater than the 1 year period.

So depending upon the kind of the future, in which we are trying to look into for the possible demands, accordingly will be going for the short run or the long run forecasting. So short run forecasting as it reflects from its term only that it is for the shorter periods so it is used for determining the kind of the raw material requirement which will be there for running the production processes smoothly.

What kind of the labour or the manpower will be required, likewise, what kind of the other consumables need to be arranged for smooth running of the system, what kind of the inventory is to be maintained so that the company can supply the things smoothly to the customers or to the production processes wherever it is required.

On the other hand, long-run forecasting helps in determining what kind of the product designs will be there, the process development, the capacity planning of the organization, location of a new plant. So these things are determined based on the long run forecasting. Scheduling is another kind of the aspect which is done with the inputs from the forecasting.

So if we see, since there is a lot of difference in the approaches which are used and the purposes for which the forecasting is used and therefore the variety of the methods are there for determining or forecasting the demand in future, which will be there.

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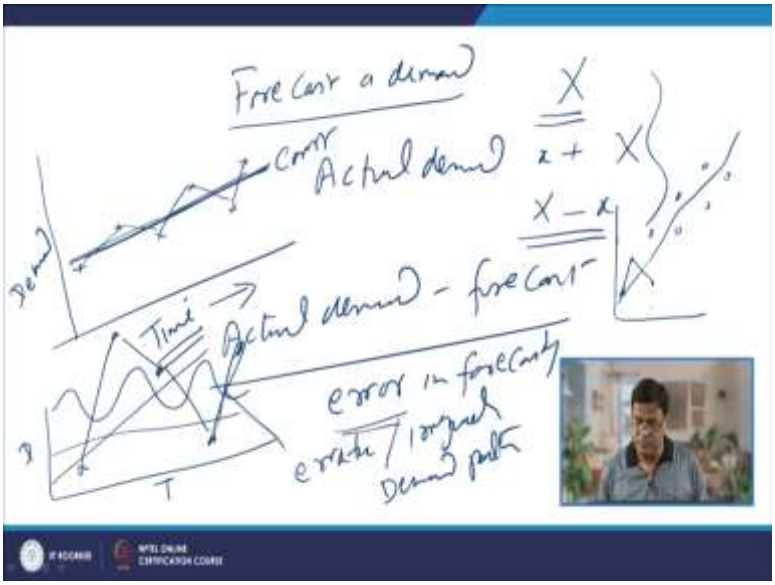

So we have seen that we tried to forecast a demand. Now this forecast based on either qualitative or quantitative method is say some value X. So it is expected that when the demand is forecast the actual demand may be different from the amount which was there identified after forecasting. So it may be actual demand maybe a little more or a little less than the forecast value.

So the difference in the actual demand and forecast leads to the error in forecasting and we always try to reduce this error so that the actuary demand is close to the forecast, the value identified after the forecasting. So the efforts are made to use such kind of the methods which will help in reducing the error in forecasting.

And why this error comes in? There is a reason behind that, like say the kind of demand which is there it is never a stable; demand will always keep on changing. So as a function of time, if we tried to track the demand, the demand may show a different kind of the patterns like this.

So here this is one type of pattern where let the variation is a little bit up and down with respect to some. So here there is no measure direction either increasing or decreasing trend. There is no cyclic kind of trends. So this is like no change kind of thing, so constant demand.

So we have seen there are various patterns related with the demands, where the demand as a function of time remains almost constant or the demand keeps on increasing as a function of time or demand changes in a very cyclic manner as a function of time.

There is one more variety of the pattern. There is one more type of the pattern in demand that is erratic. Like earlier it was here then here, then here, then here. So there is no systematic trend of the variation in demand as a function of time. So that we can say as a erratic or irregular demand pattern.

Most of the time if the time window or the period for which demand is being looked into, if that is checked, then we will notice that the demand is by a large erratic but if you see or a longer origin of the time, then it may show some kind of that trend as well. Like say, the points are changing in this manner.

So if you see just 3 points, so it will showing that there is increase and decrease. But if we keep on checking this trend, it may show that there is a continuous increase in demand or it showing a kind of the trend in the demand as a function of time. The trend is of the increasing trend.

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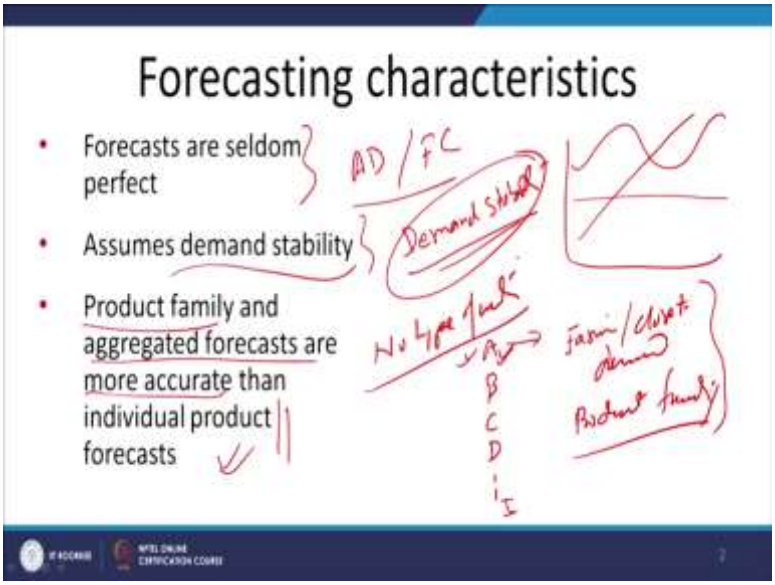

So with regard to this, what we can say, the demand has a unique feature. The forecasts are seldom perfect. That is why I have said that. Actually demand is always different by little or more amount from the forecast and that is why it is seldom perfect and for calculating or for determining the forecast we need to see that really demand is stable.

We have seen that demand stability. What it was? Like the demand is showing some kind of the pattern for some period. Like say, the demand is either continuously increasing or demand is constant or it is showing some kind of the cyclic variation. So, but that trend remains

constant for sometimes. That trend means that demand pattern is there for sometimes. So that indicates the stability in that demand.

And there is another point, like if an organization is producing the 10 types of the units. So the forecasting the demand of all these 10 types of units. So what we find that, there is always the kind of error which is observed in forecasting that is more for the individual products than the kind of the product family. It is easier, forecasting is easier and closer to the demand if we consider the product family, a group of product rather than individual products.

So product families and aggregate products are more accurate with regard to the casting than the individual products. We can find a lot of variation with regard to the forecast and actual demand for the individual products.

But when we consider the number of products of particular type together to estimate the demand, that demand comes out to be more closer to, that forecast comes out to be closer to the actual demand and that is why the aggregate forecasts or product family forecasts are closer to the actual demand than the individual forecasts.

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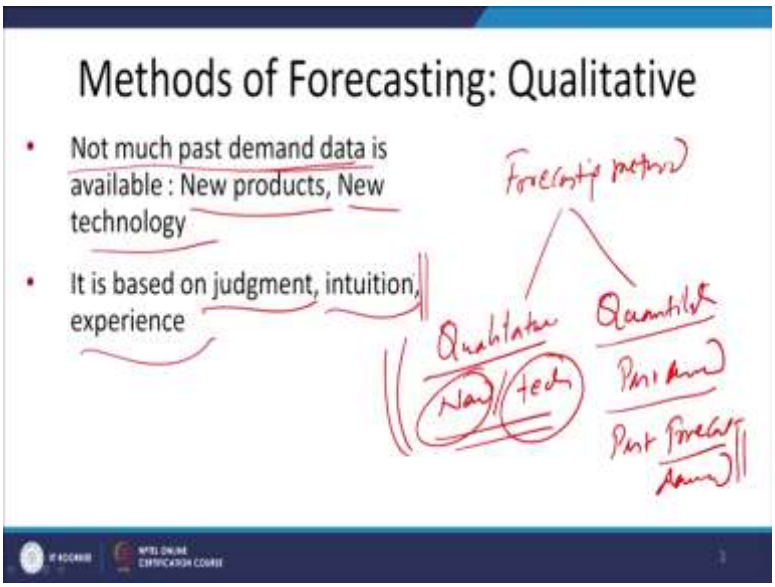

Not much past data related with that demand is available. If there are situations like, there are two categories of the forecasting methods, one is qualitative and another is quantitative. Qualitative method is used when not much past data about the demand is available. Like say the product is very new or very new technology is being brought in, for which there is no record of the demand and forecast.

So in those cases it becomes difficult to forecast using the quantitative methods, but it is preferred that the qualitative methods because there is no past demand data. So for the newer methods, newer items, newer technologies which are being launched and if you want to forecast their demand, the qualitative methods are found to be more useful.

So when there is no past data, like in case of the new products, new technologies, new items, are being launched, so to identify their forecast, the qualitative methods are used and these methods are based on judgment, intuition and the experience. So there are certain methods where the group of people will be coming together and they will try to identify the kind of the forecast which will there for particular newer product or the newer technology or newer item which is being launched in the market.

On the other hand, the quantitative methods use both. It uses the past demand data and it also uses the past forecasts and the demand both, depending upon the method, the various importance, different relative importance is given to the forecast and past demands.

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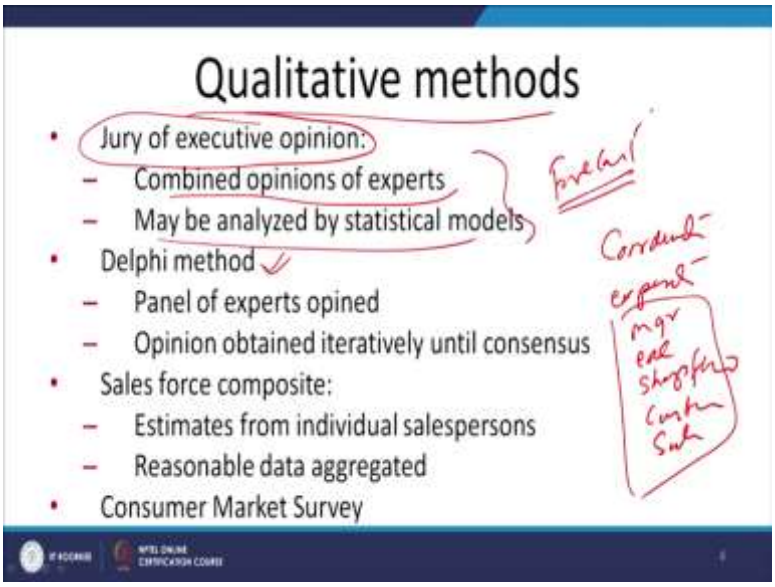

So here now we will see as far as the qualitative methods are concern the one approach is where opinion of the jury or group of the executives is taken. So in this case, the opinion of the various executives of the organization is taken and those opinions are combined together and their opinions can be analysed to see what kind of the forecast will be there for a particular item.

The method is a Delphi method where there is a coordinator and there are various experts from the different sections. These can be managers, there can be executives, there can be the shop floor people, there can be customers, the salesmen and the customer complaints.

So there can be so many kind of representatives to give their inputs regarding the kind of, so all those, the relevant people who can give the suitable opinion regarding the forecast, they are brought in and their opinion is taken.

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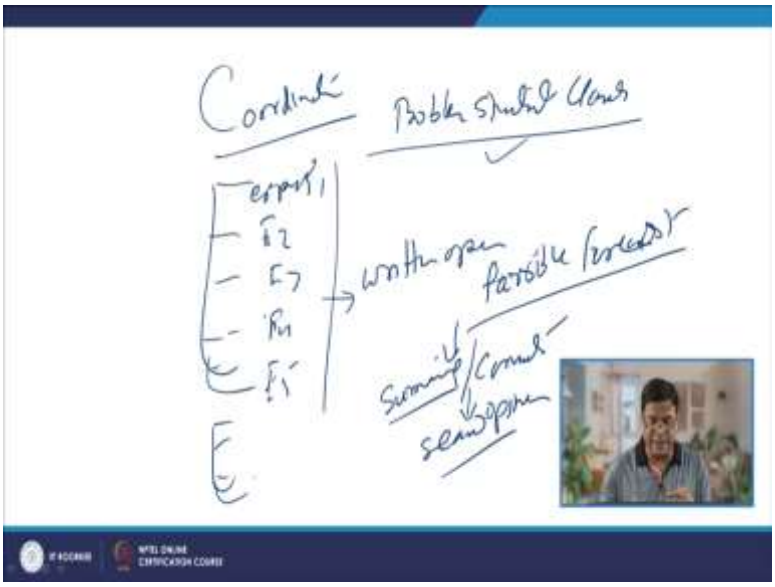

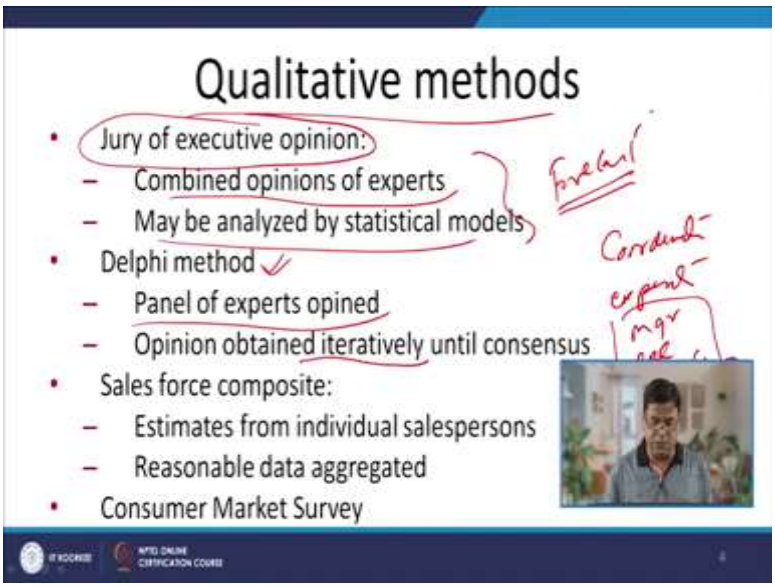

So here in this method basically first of all, the coordinator writes the problem statement clearly like what he is looking for. So say forecast of particular item is the kind of thing and then this written statement is given to the various experts. So these experts are provided with

the problem statement and suitable briefing is done. So expert 1, expert 2, expert 3, expert 4, like this, export 5 and their written opinion is taken about the possible forecast.

So the experts are given about the, experts are provided with the problem statement by the coordinator. These experts will be giving their written opinion about the possible forecasts. Based on these opinions, again the coordinator will prepare a summary and will give his comments and based on these comments again the coordinator will ask for the second opinion of the means the second time opinion of these experts.

So again the updated summary and with the comments the problem statement is given to the experts again second round and there again inputs are taken for updated sale forecast. So this process will keep on repeating until the consensus exists or the coordinator is convinced with the kind of the forecast and the points that has been considered in determining the forecast. So basically this is an iterative process.

So panel experts, opinion of panel of experts is taken by the coordinator and this is done iteratively until either consensus is there or the coordinator is convinced with the kind of the forecaster, which is there.

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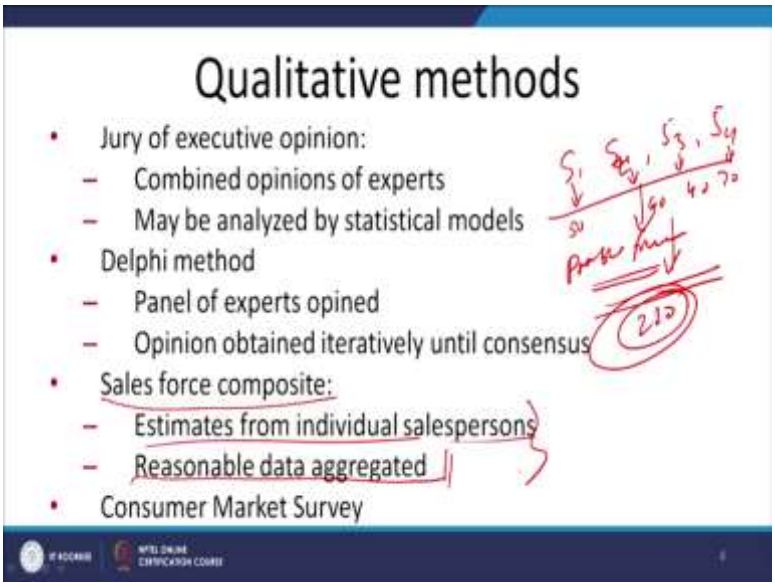

Now the sale forecast composite here, so obviously in an organization there will be number of the salesmen, say there 4 salesman 1, 2, 3 and 4. So the inputs from, so the inputs of the salespersons is taken regarding the possible forecast, what is their forecast for the sale of particular item and then a composite forecast of the sale for the next near future is obtained.

So in sale forecast means the opinion of the salesperson's regarding the sale of the item in the next period or next immediate future is obtained and then like say like 50, 60, 40, 70, this is the kind of the opinion of the forecast of the, I can say expected, the sale being expected by the different salesmen in the next time period.

So we will try to sum it up for determining the forecast of the sale or the demand of particular items. In this case it will be coming 100, 150 so 220 will be the sales forecast for a particular item. So basically a sale force composite is obtained, estimates are taken from the individual sales persons and then reasonable data is aggregated.

Whatever is a felt as a more reasonable data regarding the possibility of the sale of particular item that is taken into consideration for determining the forecast for particular item.

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And the third or the next method is consumer market survey. This is another method where opinion of the customers is taken through the development of the suitable form or by taking their opinion in person. So, regarding the possible sales or the kind of the trend which will be there for either new product or the newer technologies.

Sometimes these inputs are also used in determining the way by which the product should be designed, the processes should be developed so the forecasts their sales can be enhanced. So basically here the consumer inputs are taken to determine the kind of trend or the kind of demand pattern which we will be there for particular item either newly developed technology or the newly developed item which has been launched by that company.

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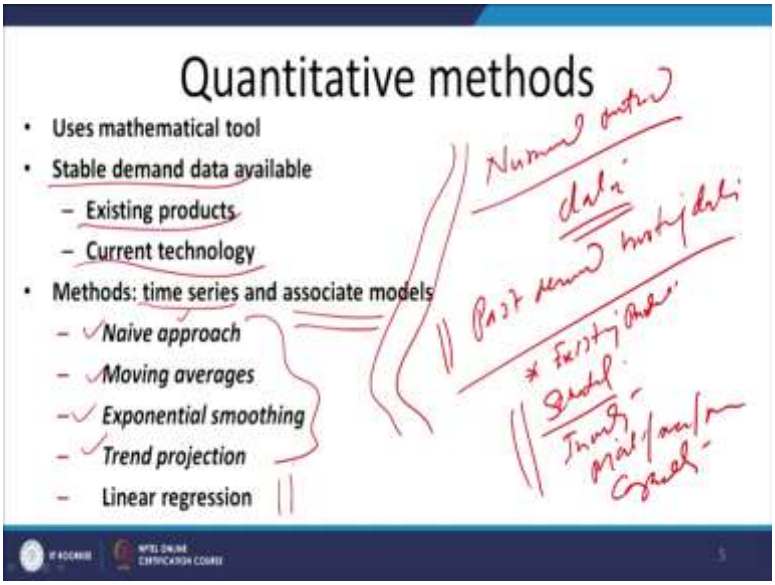

Then there is the quantitative methods, quantitative methods of course these are the numerical methods which will be using some kind of the data. Now this data, most of the time is used from the stable demand data. This is basically the past demand history data, which is used. Since when the demand is a stable and the past demand history data is available for, like say, already existing products.

The product is already there in the market or the technology is well established. So the demand for the product and the technology is showing some kind of the pattern and for which the data is already available. So it becomes somewhat the forecast using the quantitative methods become somewhat closer to that of the actual demand when we use the appropriate methods to forecast the demand.

So there are various methods, ofcourse it is very difficult to arrive to determine the forecast exactly same as the actual demand which will there in future but we can reach very close to that through the use of the suitable methods and accordingly that will help in suitable scheduling, the operations, developing the inventory, arranging the materials, man, machine or developing the new plants, locating the new plants or enhancing the capacity of the plants. So these are the uses of the forecast.

So if we know what kind of demand will be there in next future if that is identified, it will help a lot in running the organization smoothly and efficiently, while producing the things at low cost. Now as I said, there are different methods. The quantitative methods are, there are two categories of the methods.

One is that time series methods, means the methods which we will be using the data, past data, which has been there as a function of time. So the variation in demand as a function of time is plotted, that shows the time series and the based on the kind of the demand pattern as a function of time and certain characteristics as some associate models or casual models are there.

So these first four methods are basically that time series based methods where the demand of the, past demand data is used. So, naive method, moving average method, exponential smoothing method and trend projection. These are the methods which we will be using the time series and linear regression is the casual or associative model method. So, we will be going through these methods gradually.

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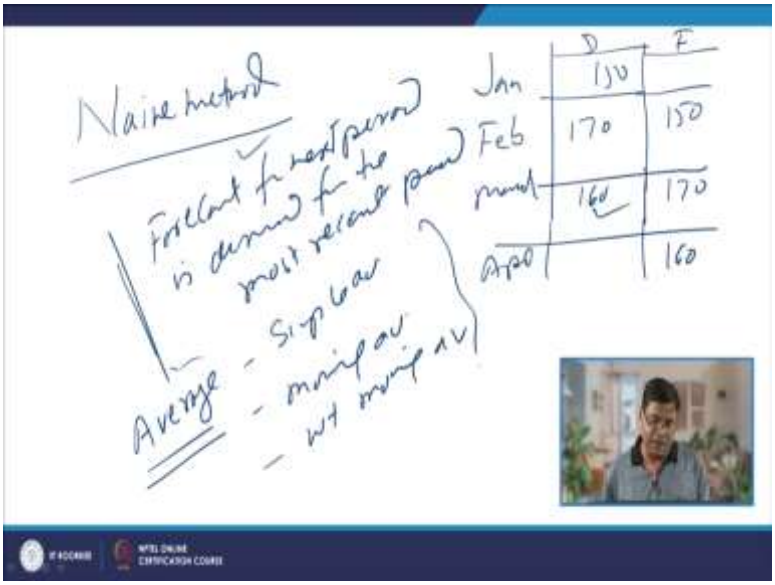

So here as far as the first method is concerned, Naive method. So, like say, since it is the time series based method where in, like say, for January the demand for a particular item was 150 units, so for February if you want to determine the forecast using this method, so immediate past demand becomes the forecast for the next period.

Say the next period, so this is the demand and here it is forecast. So here the forecast for February becomes the previous years, previous periods demand. Say in February, if the actual demand was 170, then for March 170 becomes the forecast. So basically in the March, if it is like say 160, the actual demand is 160, then for April, the demand of the March, becomes the, 160 becomes a forecast.

So in this method, the forecast for next period is the demand of the most recent period. So this is the simplest method, whatever the demand of the previous period that becomes the forecast for the next period.

The next method is like the average method. In average category there are 3 methods, like simple average, moving average and then weighted moving average. So these are the three methods which are of the average category.

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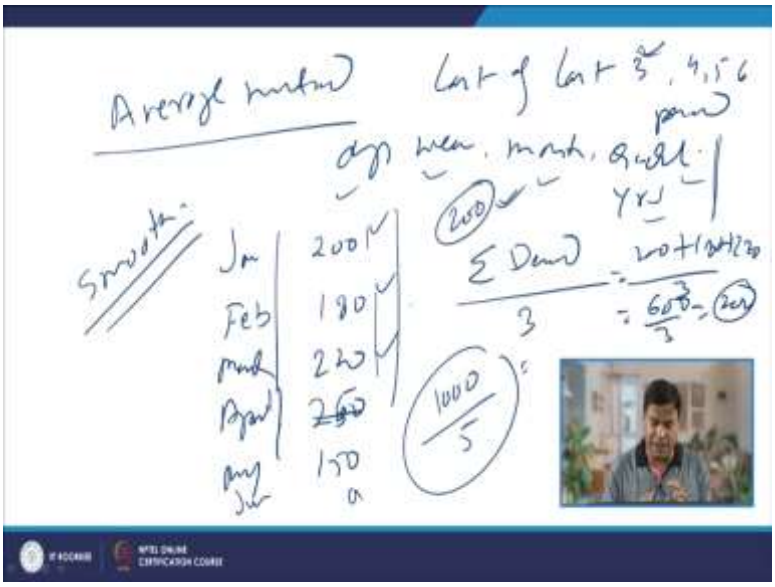

So in a case of the simple average method, so we select that like how many periods we will be considering like the last, the demand history of the last 3 or 4 or 5 or 6 periods, which may be in terms of the, like say weeks, days, months, quarters or like say years.

So how many days, weeks, months, quarters or the years data is being used with that is what we can determine based on the kind of the suitability and the kind of trend which is being shown by the forecast errors in the past. So what we try to do, we try to determine the kind of periods which will be considered.

Say if we start with the 3 periods. More the periods are taken the effect of the demand fluctuation of the past will be reduced and the data the fluctuation will be more smooth. Fluctuation will be smooth so we do not get any benefit of the fluctuations or the variation in the demand of the past periods in determining the forecast.

So like say, in case of a simple average method for January, the demand was like 200, for February demand was 180 and say for March the demand was 220. So what we will be doing

since there are three periods. So we will be determining the sum of all these three periods demands divided by the number of periods that is 3.

So here 200 plus 180 plus 220 divided by 3. So again, it will 600 divided by 3. So 200 will be the forecast for the next period. That will be the say April. So this is how it is determined. If we go for a like say the next period's demand is like 250 and for May it is 150. So now what we will have? Like a 250 and 150, 400 and this is again 400 and 600.

So 400, 400 and 200, 1000 divided by 5, so this will be giving us the forecast for the month of June. So here basically we are simply using the average of the past certain periods to determine the forecast of the next period in case of the simple average method. So it does not indicate basically the fluctuation.

If you see the previous example where we had that average 120, so it will, average was 200 for the April month. So in this case it did not consider any fluctuation from the forecast. Like say the January demand was 200 then February 180 then for March it is 220. So these fluctuations are not taken care of when we use simple average method.

So there are various methods which will be looking into these fluctuations and also the forecast. Here we are not using the, in these methods, we are not using the forecast. There is another category of the forecasting methods where forecast data as well as the actual demand data, both are used for determining the forecast.

So now I will conclude this presentation. Basically in this presentation I have talked about the different methods of forecasting and I have talked in detail about the simple averaging method of the forecasting. Thank you for your attention.