Modelling and Analytics for Supply Chain Management
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Lecture 46
Forecasting: Exp1ntial Smoothing Method

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Hello and welcome to Modelling and Analytics for Supply Chain Management. We are into week nine, lecture forty six that is Forecasting and MSDM techniques in supply chain and today our topic is Forecasting in the exponential smoothing method of forecasting.

Now, just let us have a recap, in the previous week we had told you why forecasting is important and we have said primarily two reason as to why forecasting is important. One is, let us say my actual demand is hundred units and I have forecasted a demand of hundred fifty units.

So, fifty units extra I have produced, so I have to store them and what will happen over time as in when newer models, newer technology is coming, these extra fifty units that I have manufactured will cannot be sold, will not be sold and as a result they will become absolute. And all my money that has gone into producing those extra fifty units of components are gone. So, that is a of money, this is one problem if I do not forecast correctly.

The other problem is the under forecasting that means that first one is over forecasting. I forecasted over and above the actual demand next is under forecasting that means I have forecast lesser then the actual demand. So, my actual demand is hundred as I have mentioned but I have forecasted eighty, so what has happened I could not sale twenty units, loss sale,

loss sale is fine and I can manage but what will happen to the lost market and that is what we have discussed last week.

What will happen to lost market my market is gone, my customers will not comeback, they will shift to my competitor. Unless I have a monopoly, unless I have some unique product, unique technology and if I am in a "ME TOO" segment they will just shift to the competitor whose product is readily available. And if you see I am not going into management strategy, management decision making, etc. but the (())(2:18) decision to come out and sale in the physical store rather than fully depend on the online model, online mode is only because of this.

That if it is not there in the brick stores, physical store it is a loss sale, loss sale means you are giving market to the competitors. Other players are having a free round in that physical market wherein people can physically see the laptop, operate it, type it and then buy it but Dell was not doing that, so Dell's decision to comeback into this market is because they have realized that you are giving away space to your competitors in this physical market.

So, as we said under forecasting that means forecasting a quantity which is lesser than the actual demand. It not only results into loss sale, you can observe that lost sale shock but you cannot absorb the shock of lost market, so that is why forecasting becomes very very very important in supply chain, point number one.

Point number two again that we discussed in previous class, in the previous lecture is that this forecasting has to be for new products different methods of forecasting, for existing product different methods of forecasting, innovative product one method of forecasting, so different types of situation, different methods of forecasting.

Third thing that we learned in previous class is if my sale is more or less stable, constant then we can use a simple method of forecasting that is whatever the sale was in previous month it will be the sale for the next month as simple as that. This applies to all your necessaries, your local shop he knows exactly how many eggs will sell, how many bread pieces will sell because his customers are within only that vicinity, this example also I have gave in the previous class. So, this is what.

Second is sometimes that constant level is more or less maintained even in our life also you will see our income does not change that much. So, our consumption level also more or less remains constant. So, the companies were forecasting with middle scale consumers demand

patterns, they are forecasting also for (())(4:41) items it is constant only thing is the minor error that noise will be there.

Sometimes this demand is constant but seasonal. For example, winter garments then for example your marriage season dress material, etc. So, constant but seasonal, sometimes it is constant but demand is increasing. Examples of constant plus seasonal this is just a recap example of seasonal is exercise books for school children. Seasonal means peak at the beginning of the academic year and then slump because you have purchased all the books and exercise copies required at the beginning of the year and then there is a slump.

So, these are things that are there. So, different methods, different situations different methods of forecasting this is what I want to say. Different situations different methods of forecasting. Now, and we learned the moving average which takes care of the recent sales should be given more importance. Today we will learn another method called exponential smoothing. What is exponential smoothing?

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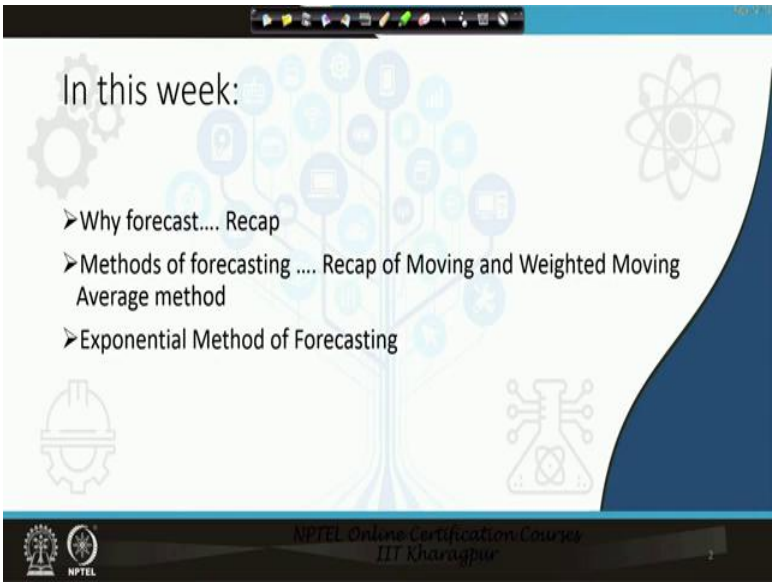

Exponential smoothing is very simple and this is what we have done already.

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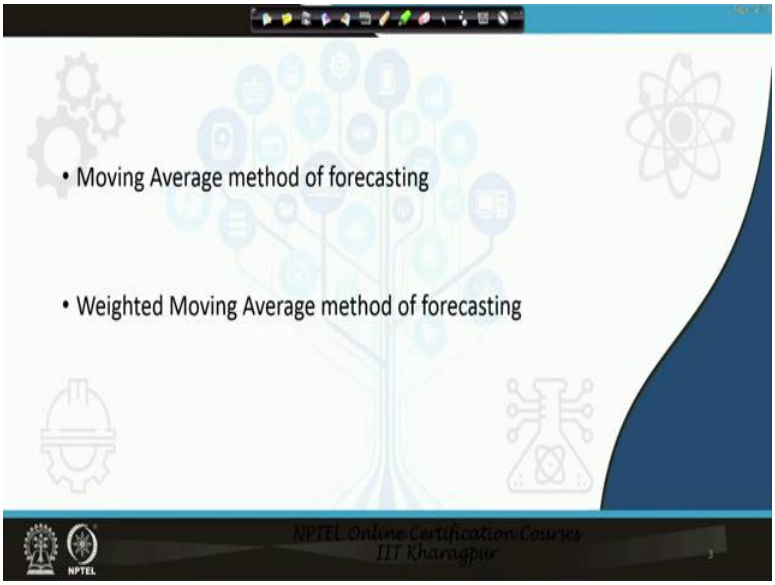

Moving average, weighted moving average we have just finished this is just a recap.

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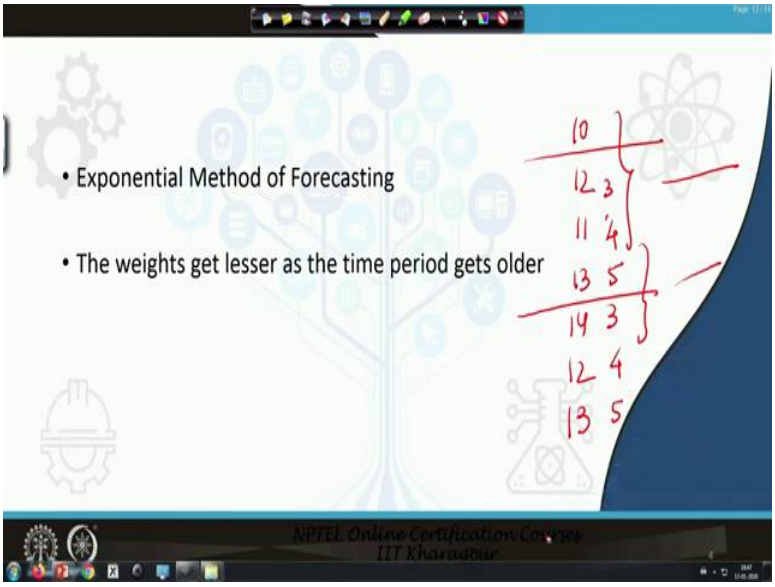

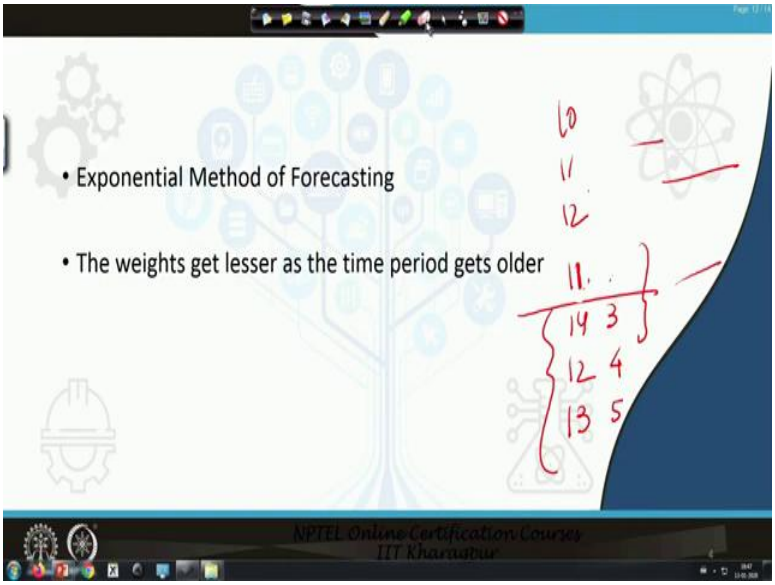

Today we will do Exponential method of smoothing. What is exponential methods of smoothing? Now remember we were saying that our demand was 10, 12, 11, 13, 14 and 12. And then let us say again 13. What were we saying? We were giving more weightage to the recent ones. More weightage to the recent ones. We were giving more weightage to the recent ones based on this you are forecasting something, based on this you are forecasting something, etc.

Exponential smoothing rather because of this, because of this what were we doing? We were basically ignoring this, we were only doing considering this when we were calculating mean square error nothing else. We were forecasting based on the very recent ones. The forecasting based on very recent ones, what exponential smoothing does is Exponential smoothing is saying that no, we will give a just hold on let me erase it.

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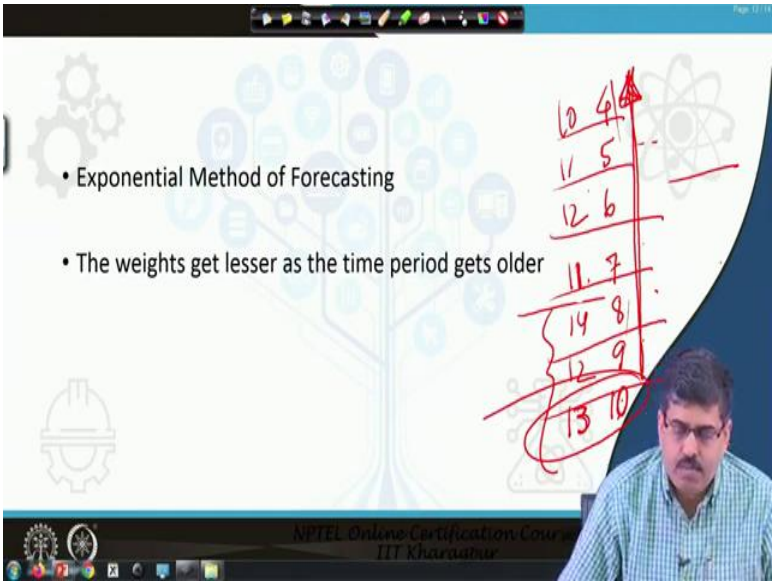

Exponential smoothing is saying that let us give one weight only, let us give one weight, let us give this weight as 10. Exponential smoothing will automatically keep on reducing the weight as we move away from the most recent data points. Look my most recent point was 13, exponential smoothing is saying that as we move away from the more recent data point, as we move away from most recent data points my weights are also coming down.

And Exponential smoothing is saying no need to calculate the multiplicative values, we will have one formula that will auto calculate. So, in a nutshell what I want to say is exponential smoothing and moving average are almost similar, exponential smoothing and moving average are almost similar.

Exponential smoothing the weights are auto calculated we give only one weight, in moving average what happens the weights we will have to give for this year, previous year, previous to previous year, etc. Exponential smoothing the weights are auto calculated. So, this is what we want to say.

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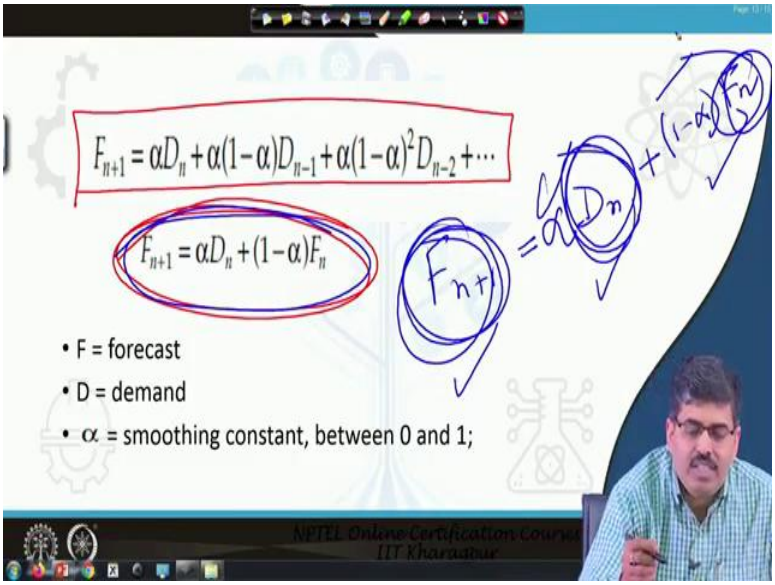

What is the formula for exponential smoothing? This is your formula, now do not get confused with so many alphas and all that, no need to get confused sir, you consider only this formula. You consider only this formula. What it says Fn plus 1 that means forecast for tomorrow, for the next period depends on a constant alpha demand for today that is forecast for tomorrow definitely depends on today's demand because otherwise how will I forecast because I do not know today's demand I will forecast for tomorrow. No, not possible.

So, definitely depends on today's demand and a portion, and a portion of yesterday's forecast or that means this terms forecast, so you are forecasting tomorrow based on today's actual demand and based on today's forecast what was the forecast? Repeat you are forecasting for tomorrow, you are forecasting for tomorrow based on today's demand and what had been today's forecast. You are forecasting tomorrow's temperature based on today's actual temperature and what was the forecast for today's temperature and you are giving some weightage to it that is alpha and 1 minus alpha.

That is it, nothing else. So, you are giving some weightage to present demand and weightage to the forecasted demand.

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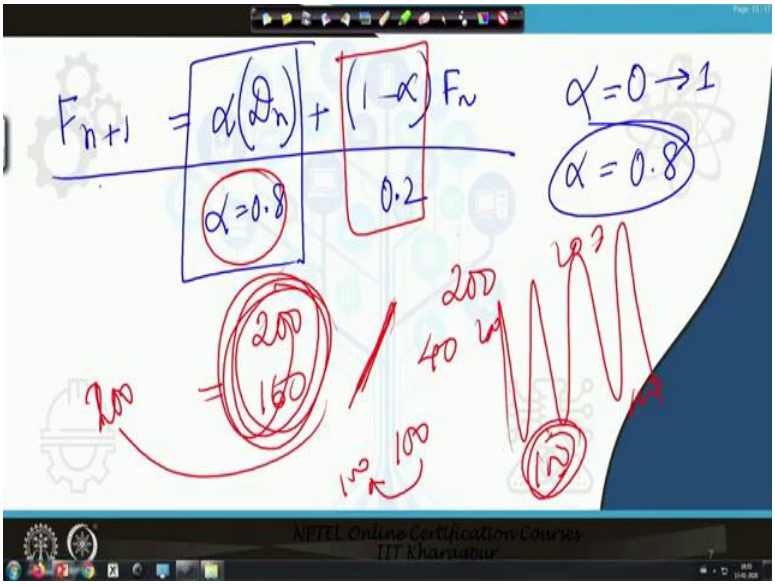

Now, let us see the fun here what is the fun? Let us see what did we say? F that is forecast for tomorrow is equal to, this was your formula? So, forecast for tomorrow is dependent on your present demand and your present forecast, what is alpha weight? Now, let us see a value of alpha is between 0 to 1. If you give more value to alpha, let us say alpha you are given 0.8. Alpha you have given 0.8 assume, let us see because value of alpha is very critical in this exponential smoothing.

You have given value of alpha as 0.8 what will happen? Alpha will become 0.8 and 1 minus alpha will become 0.2. Value of alpha is 0.8 and 1 minus alpha is 0.2. What does that mean? You are giving more importance or more weightage to the present demand and only very less weightage to the forecasted demand. With this more weightage to the present demand, you are forecasting for tomorrow. With this more weightage to the present demand you are forecasting for tomorrow, assume today's demand was 200 and you have given more weightage 0.8 weightage..

What will happen, and so you have said, and assume your forecast also was 200, your present demand is 200 and your forecast also was 200, so what has happened alpha is 0.8, so you are saying 160. And here what will happen? 40. So, with that your forecast becomes 200 for the next year. Now, you have given more weightage here but if something had happen that time, this year maybe some extra sale, may be some new event, may be something, something, something. So, you have taken that and that has reflected in the next forecasting, next month suddenly, next month suddenly if your demand falls to 100. Actual demand, what will happen to next month's forecast?

Again it will be 0.8, so next month you will forecast again 100. So, whenever there is tremendous fluctuation in the demand sometime 200, next day 100 and next day 200 and next day 100 and if you give more weightage to the actual demand then your forecast will be, their actual demand will have more weightage in the forecast so your forecast also will go wrong.

So, giving more weightage to the actual demand in exponential smoothing and if your forecast is and your demand is fluctuating tremendously, then giving more weightage to actual demand, so I repeat if your demand is fluctuating tremendously, and giving so giving more weightage to the actual demand, next time if the demand is down, your forecast gets affected and then your all your future planning gets affected. So, this if alpha smoothing constant is very is very important.

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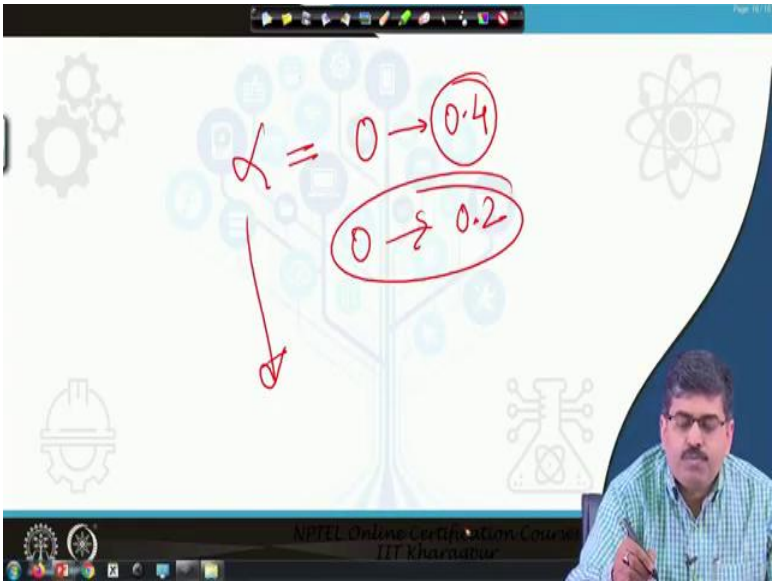

So, normally we take the value of alpha between 0 to 0.4 even 0.4 is bit problematic. So, normally we take between 0 and 0.2 though there are methods by which you can easily identify what should be the value of alpha, how much should we actually take. But normally it has been seen that you can take a 0.2.

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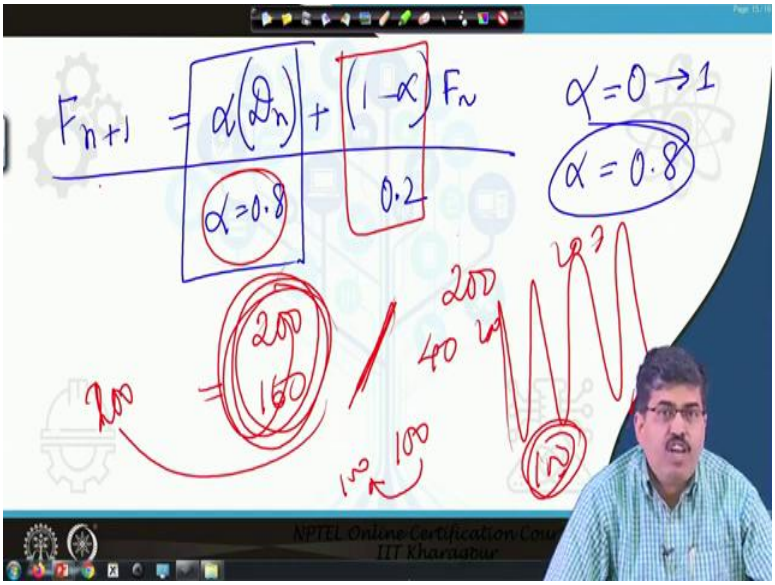

So, yeah this was my previous formula Fn plus 1 is equal to alpha Dn 1 minus alpha Fn. Now, let us let us let us do it here only.

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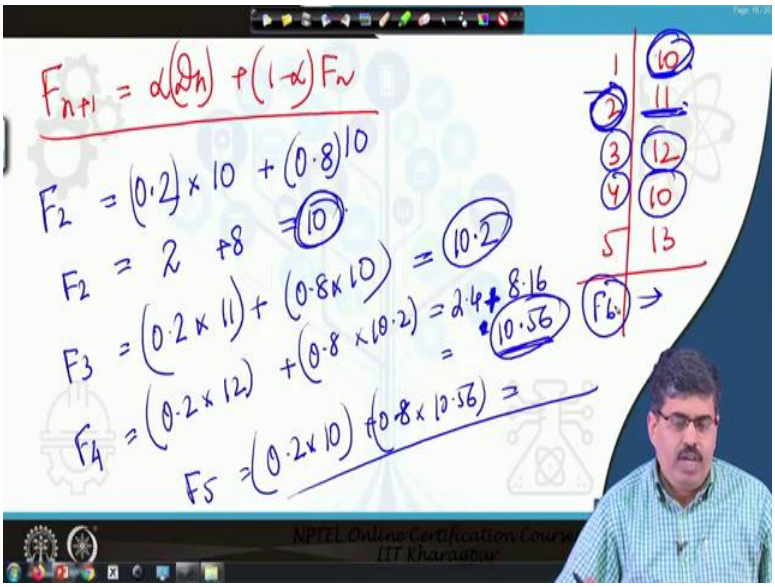

Let me erase it and then we will see. Let us take the fresh sheet. My formula was Fn plus 1 is equal to alpha into Dn plus 1 minus alpha into Fn. This was my formula now here is my demand 1, 2, 3, 4, 5. Demand is 10, 11, 12, 10, 13. So, 1, 2, 3, 4, 5 is our time periods and 10, 11, 12, 10, 13 is your actual demand.

Now, you are forecasting for period 2. You are forecasting for period 2, so F 2 is equal to what is the alpha value we just set 2 into demand for period n, 2 into demand for period n, 2

into 10 plus 1 minus alpha will be what 0.8 and if alpha is 0.2, 1 minus alpha will be 0.8 into forecast for period n.

Here first here there was no forecast. So, we assume that the forecast and actual demand was same, so we will take it at 10. We assume that the forecast and the actual demand is same for the first since here it is no forecast. So, what will it be? 2 plus 8 so, my F 2 is equal to 10. What will be my F 3 F 3 will be 0.2 same alpha into demand what is demand in F 3 11 plus 0.8 into forecast for Fn. Forecast period two. What was the forecast for period 2? Forecast for period 2 was 10.

I am repeating F 2 the first one, F 2 was 0.2 the smoothing constant alpha into demand for period n, the first period 10 plus 0.8 one minus alpha into forecast for period n first period where we said forecast and actual demand is same, so 10 so what was your F 2? 10 that is 2 plus eight into 10.

F 3 is what? 0.2 into demand for period n and F 3 is 0.2 into demand for period 2 that is 11 plus 0.8 into forecast for period 2. What was your forecast for period 2? 10. So, this becomes your 2.2 plus 8, so that is 10.2.

F 4 becomes 0.2 into 12 that is demand for period 3 plus 0.8 into what? 10.2. So, this will become 2.4 into 8.16 I think. 8.16, sorry this is plus that is equal to 10.56, so that is your F 4. F 5 will be what? 0.2 into 10 plus 0.8 into 10.56. So, in this way ultimately you will come to forecast for period 6. In this way you come to forecast for period 6 so, that is your exponential smoothing method. So, in this way we calculate it, we have done it by hand but you can easily take an excel and you can do it accordingly. So, this is your exponential smoothing.

So, what have we learned till now? We have learned why forecasting is important? What are the issues in forecasting? And then your moving average, weighted moving average, exponential smoothing. Now, there are other qualitative ones but before starting that let me say in the next week what we will do? We will do the trend ones that is seasonality, sorry we will do the seasonality then we will do the trend, then we will do the seasonality and trend.

Now, what we will do is yeah. Now what we will do is see there are this are all numbers when you can forecast, we are forecasting with when you already have some data, some numbers. You are forecasting when you have data some numbers. What will happen when you will do not have numbers? What will happen when you do not have numbers?

Now, see when you do not have number there is a issue, when will this happen when you do not have numbers, it will happen for a new product as we were saying embossing machine it will happen when you do not have numbers, it will happen when you have a new product. Totally new to the market, so what you need to do? You need to do focus group, you need to do Delphi technique. What are these? The people who are knowledgeable, who have knowledge about the product, they will sit together and each one will project what is the sale or what can be the sale. What can be the sales?

So, I project a sale of 100 units, my colleague in another departments projects sale of 150 units and another projects 130 units, so this is primary, each one has a different projection, the fields sales executive projects the sale of only 80. So, 80, 100, 120 , in the next round so, I have given my justifications for arriving at a number call 120, my colleague has given another justification for arriving number 150, the field sales person has given another justification for arriving at number 80.

So, all this information along with the justifications are now send to everybody who has attended that exercise and they, and myself I see all the justifications that are given by my colleagues and then I have a chance to revise whatever I have said, whatever I have said as my projected sale or I have a chance to defend that 120 that number I have said at the beginning. If I have said 100 I defend and if I have said 120 I defend, so I defend whatever I have said at the beginning.

So, either I revise my projection or I defend my forecasted figure that I have mentioned. So, this will continue till, and not only I do it but all the others do it, so this will continue till everybody arrives at a consensus number. This has been used for many many years now this Delphi technique but very recently what is happening is the market is behaving in such a manner that unless you are very very quick, very prompt in introducing the product in the market, your competitor is there to compete with you and to remove you out of the market.

So, but this Delphi technique takes time to arrive at a consensus number but what does the market want? You innovate today, introduce it tomorrow but Delphi technique is a time bound activity between innovation and introduction, after innovation it have forecast, manufacture, introduce but today what they are saying innovate, send it in the market let the market pull up the demand.

So, innovate put it in the market let the market pull up the demand, then go back and manufacture, something similar to all your e-business models. Let the order generate then I will do the root planning and that is why I am asking the customers to wait for 1 day or 2 days.

So, whenever I am ordering through Amazon and Flipkart it is showing 1 day delivery, 2 days delivery and that is the time I am giving Amazon and Flipkart to assimilate things. Same thing is happening with any new product introduction, let the concept flow, let the product be there in the advertising slots, let it be in the online portals and let the demand pickup then I will manufacture back end.

So, this Delphi technique as such it is taking time, it is taking time between innovation and introduction in the market, but today market is not giving time, so another way by which companies are relook, having a relook at it is that the field sales executive knows the market most, not the sales manager, the field sales executive knows the market more because he or she is doing the rounds with the dealers, with the distributers, with the wholesalers, with the retailers. So, there feedback, there forecast and these field sales executive will give always a very very guarded forecast, it is only the sale manager who gives a jacked up target and all that based on which the targets are given.

Anyway, field sales executive give very very guarded feedback forecast, so use the sales executive's forecast, use the sales executive's forecast and then go into the market first round. See the market reaction, then may be go for Delphi technique. Thee earlier model of having Delphi technique directly before product introduction that is slowly going away because the time to introduce in the market is becoming very very short and this is having a tremendous impact on supply chain management.

How do you do the fleet planning, etc? How do you do the fleet planning, etc.? Everything now is going in a topsy-turvy because there is no time being given for the market to do this.

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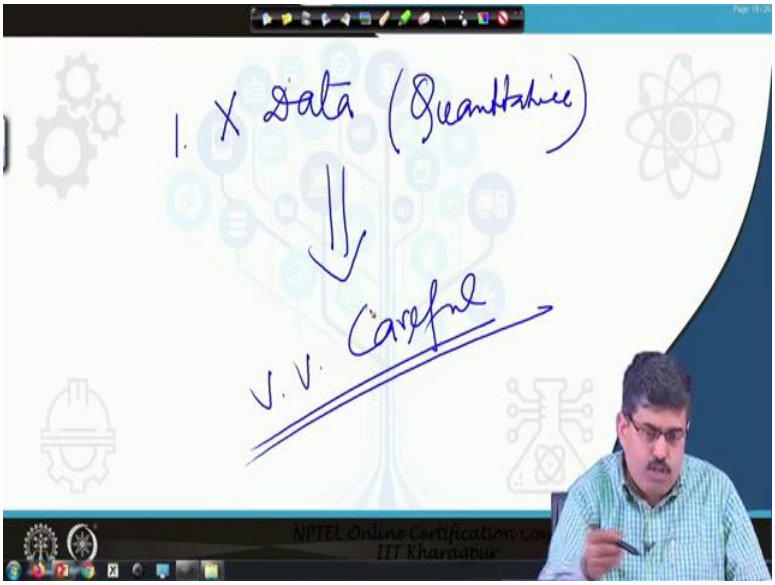

So, what I want to say is for the methods of forecasting where there is no data, no quantitative data you will have to be very very careful. As an analyst you just cannot say that this is the data I have forecasted this. Have you looked into horizon? Have you looked in to business perspective? Have you looked into business scenario?

Then have you forecasted or just because you have put the data into machine, used some method, some result have come you have given it to the management. That should not be the case, you should look at it, as I have gave you glaring example now, today there is no time to market, so the traditional methods of forecasting might not work. So, be very careful about this.

So, we have learned, so up till now what have we done? We have learned how to forecast methods, what are the issues in forecasting, what we should be careful about, simple average, moving average, weighted moving average, exponential smoothing and qualitative method under qualitative method we did the discussed about Delphi technique and how you have to innovate on and renovate actually the Delphi technique. So, with this we will end today's lecture, we will pick up some other topic in the next class. The other methods of forecasting that is forecasting (())(28:26), forecasting with trend in the next class. Thank you.