Decision Support System for Managers
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Week - 03
Module - 01
Lecture - 11
Decision Support Systems for Forecasting

Hi, welcome to the 1st module of the 3rd week on our course "Decision Support Systems"! Today we are going to discuss about forecasting, forecasting systems; how does it help the decision maker.

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So, we start with introductory concepts on demand forecasting and demand forecasting is a technique which is widely used for planning and other related decisions about which we are going to discuss. Because you must know, what is forecasting? What are the commonly used techniques? And how does it help the decision makers?

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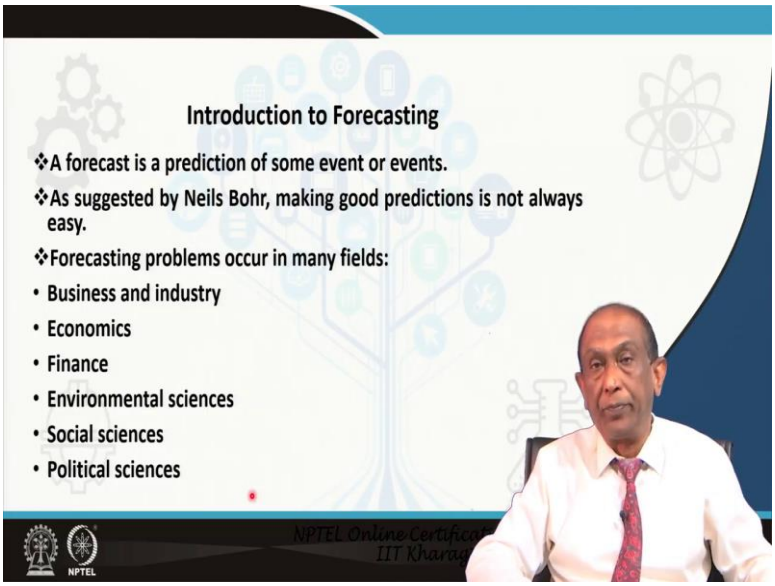

So, what is the forecast? A forecast is a prediction of some event or events. Making good predictions if not always easy, because forecast is the forecast. So, there will be some error involved in it and if the time horizon over which we are going to forecast if it is a longer period then the amount of error that will creep in this prediction will be larger compared to the situation where the time period is short.

Forecasting problems occur in many fields. For example, business and industry, in the area of economics, finance, environmental science, social science, political science, everywhere this technique is widely deployed.

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The reason that forecasting is so important is that prediction of future events is a critical input for planning and decision making, because without forecasting one cannot undertake any planning.

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Forecasting have got wide usage in various areas. So, let us first talk about the usefulness of forecasting as a technique in the domain of operations management. Business organizations they routinely use forecasts of product sales or demands for services for the purpose of first production scheduling.

If we know what is the total amount of production that is needed for a particular product or different products. Then we are going to properly schedule those products in the machines and the equipments that we have in the assembly line or in a manufacturing shop floor.

Forecasting is needed for stock control, which is commonly known as inventory control problems. Forecasting is used in managing supply networks, finding out the requirements of manpower, the staff and also it has got wide usage for planning the total amount of capacity that one must have in its manufacturing environment or service environment. So, for capacity planning we need forecasting as the primary input.

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Forecasts may also be used for determining the product that needs to be manufactured over a period of time in order to maximize say revenue or profit or to minimize cost. These kind of problems are basically product mix problem determination of product mix. So, forecasting is needed to determine the mix of products or services to be offered and the locations at which these products need to be produced.

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So, in operations management forecasting is a very important subject. Forecasting is also widely used in the area of marketing management, marketing managers they need the amount of sales that can be undertaken over a period of time and how these sales they are going to vary with respect to the level of expenditure that is being undertaken for say advertising promotions.

So, forecast of sales response to advertising expenditures, new promotions or changes in the prices of the product is very important. For evaluating how effective these policies are, to determine whether the organizational goals are being met, and if not, what the amount of adjustments is that need to be met. So, for all these, forecasting is required.

So, you see forecasting decision support system has got a major role for organizations to achieve their long term goals.

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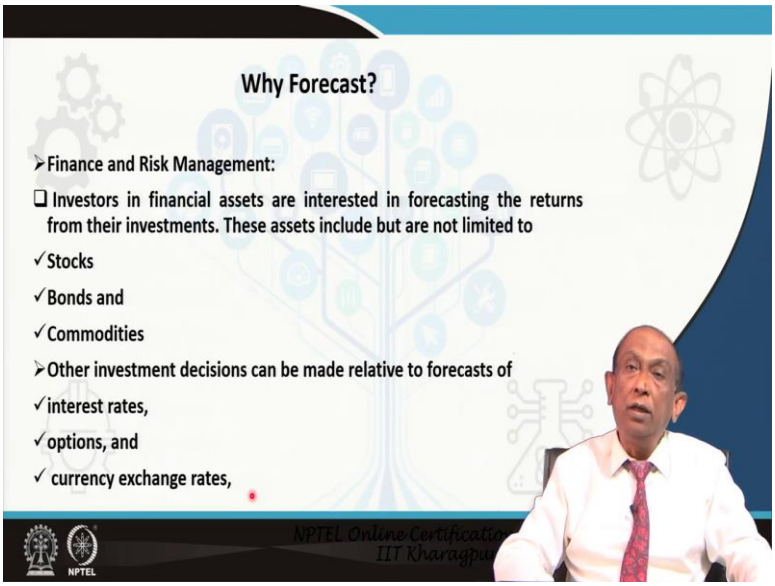

Forecasting has got lot of importance in the area of finance and risk management. Investors they need to know, what is the return that they are going to get out of the investments that they are planning to make on say stocks, bonds, commodities and things like that.

Until and unless the return on investment is adequate, they are not prepared to invest and whether to know that the return that we will get is satisfying their needs or not, you need to make a forecast of these returns.

Other investment decisions where forecasting plays an important role is in their area of finding out how the interest rates are going to vary over a period of time, the different options how the currency exchange rate is going to fluctuate over the time horizon.

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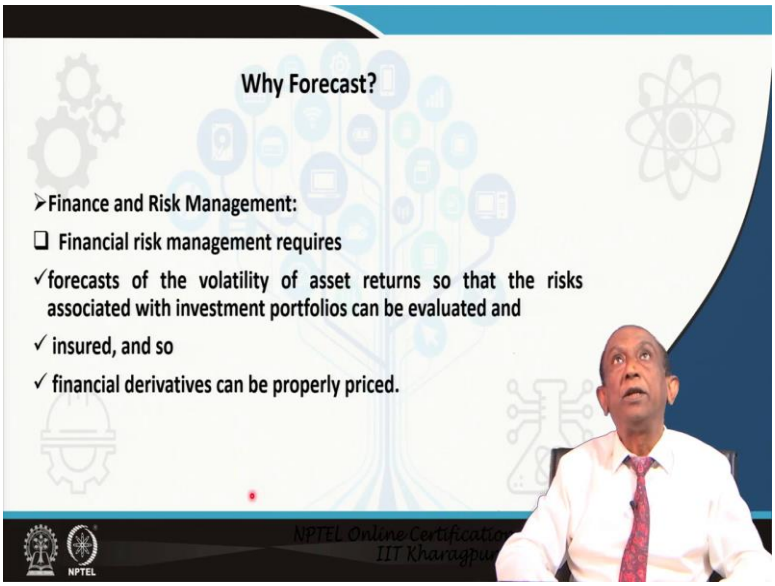

Financial risk management requires forecasts of the volatility of asset returns so that the risks associated with this investment portfolios can be evaluated and insured and financial derivatives can thereby be properly priced.

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Governments, financial institutions, they are also interested in predicting the changes in the major economic variables. For example, gross domestic product how it is going to change over a period of time, what is the expected population growth? What will be the rate of unemployment at the end of the financial planning year?

How the interest rates are going to fluctuate? What will be the rate of inflation? What is the rate of job growth? And various other forecasts related to production and consumption quantity over the planning horizon. So, even in the area of economics and related planning, forecasting techniques have wide usage.

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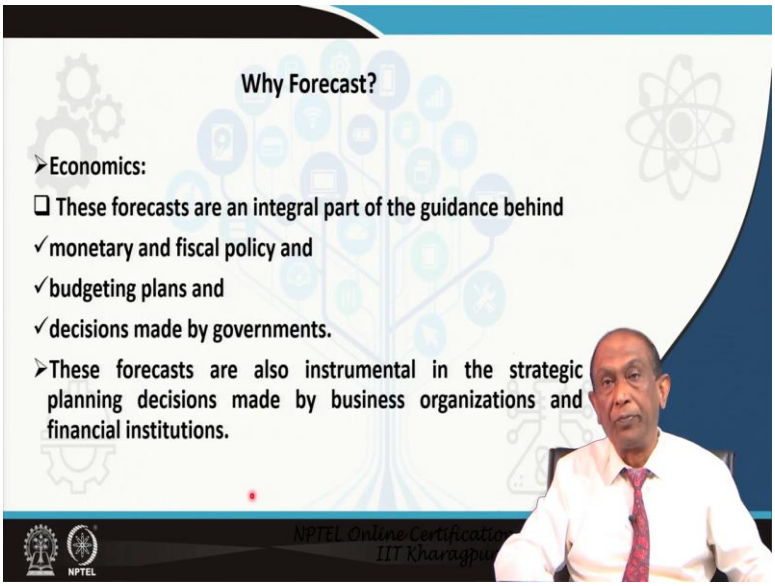

Forecasting also guides monetary and fiscal policy, budgeting plans and decisions made by governments. These forecasts plays an important input in strategic planning decisions made by business organizations and financial institutions.

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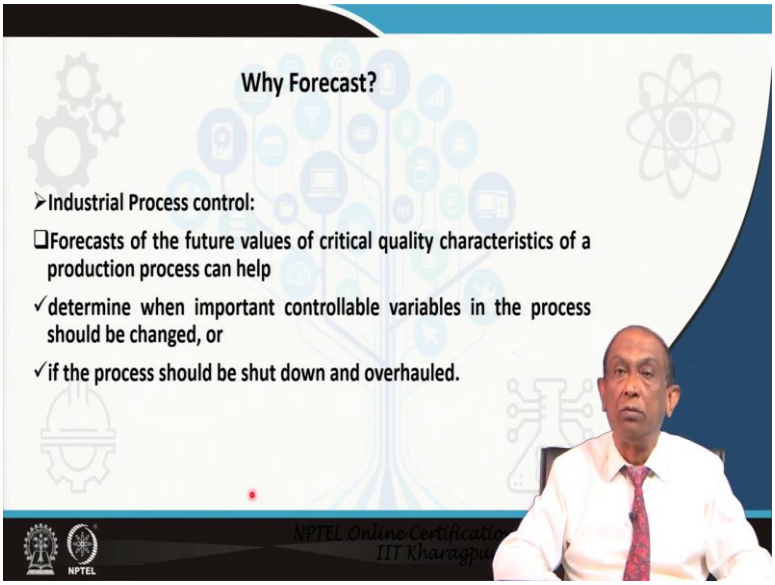

Even in the area of industrial process control forecasting plays critical role in determining when important controllable variables in a process should be changed, whether the process should be shut down and overhauled.

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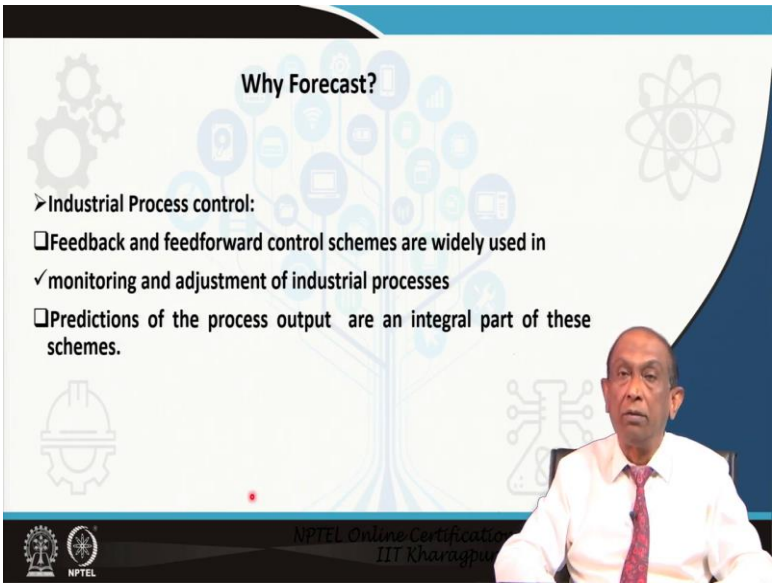

Feedback and feed forward control schemes are widely used in monitoring and adjustment of industrial processes. Predictions of process output is can also be done through these forecasting techniques.

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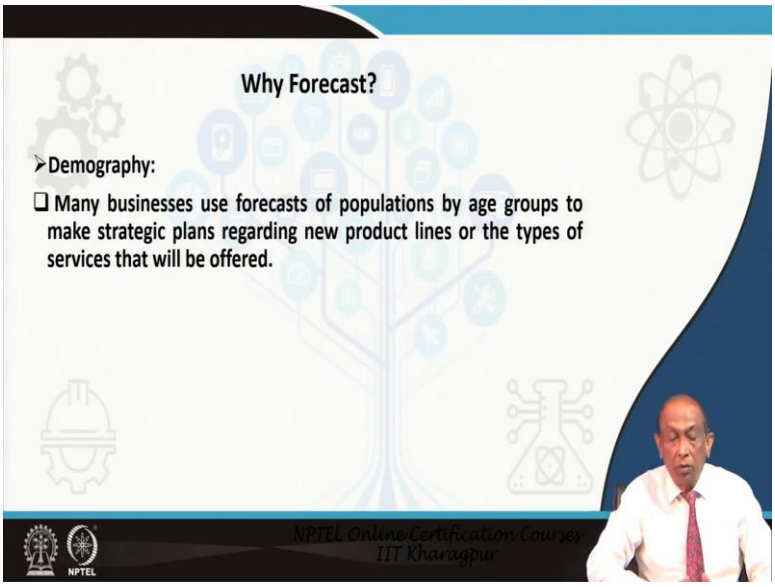

Forecasting as you have already mentioned is the basis for all planning decisions and in the context of why we use forecasting, let us talk about the deployment of forecasting techniques by demography. Many businesses use forecasts of populations by age groups to make strategic plans regarding the new product lines that the companies are going to introduce or the types of services that are going to be offered by them.

And forecasting has got an important role in supply network management.

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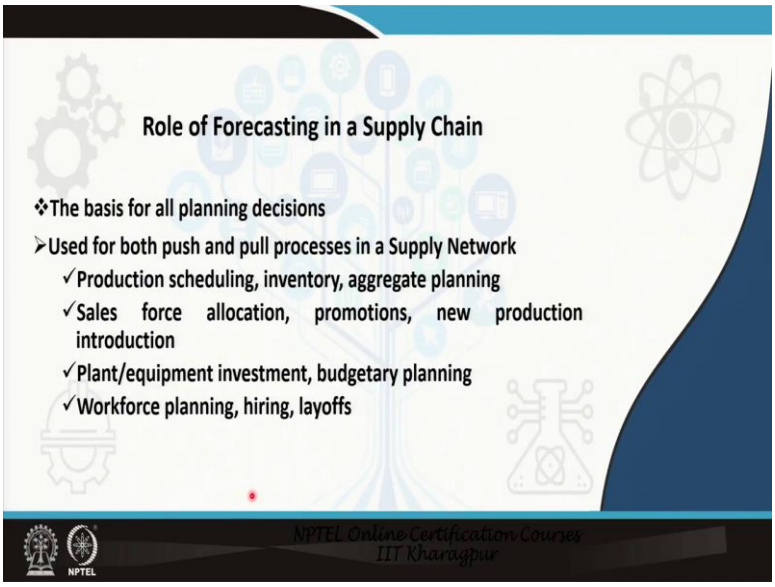

Forecasting is the basis for all planning decisions used for both push and pull processes in a supply network. What is this push process in a supply network? Here the manufacturers they are manufacturing products and keeping it as finished goods stocks.

In anticipation that whatever they are producing customers will buy those products if they do not then this finished goods inventory will be carried by the company and corresponding interest cost they have to be bear, whereas in a pull process manufacturing takes place only upon confirmation of order from the customer.

So, here the question of accumulation of stocks or inventory it is practically not there. So, related to both this push and pull processes forecasting is used for scheduling production for managing the stock, this is used for aggregate planning, even you find that forecasting is used in sales force allocation, promotions , related to new products.

When we are going to introduce new products if you look at the product life cycle curve during the infant mortality period companies are not sure of how much will be the off tech whether the customers we like the product, how much they are going to buy, if they are not going to buy then the demand for those products will not be there. So, if they are over producing that is a problem.

So, forecasting plays a very important role when companies are going to introduce new products. The same techniques are used for plant or equipment investment, how much money should be spent in constructing new plants, buying new equipments, for budgetary planning, for planning the requirement of new workers that is for workforce planning, hiring and even layoffs forecasting has got wide usage.

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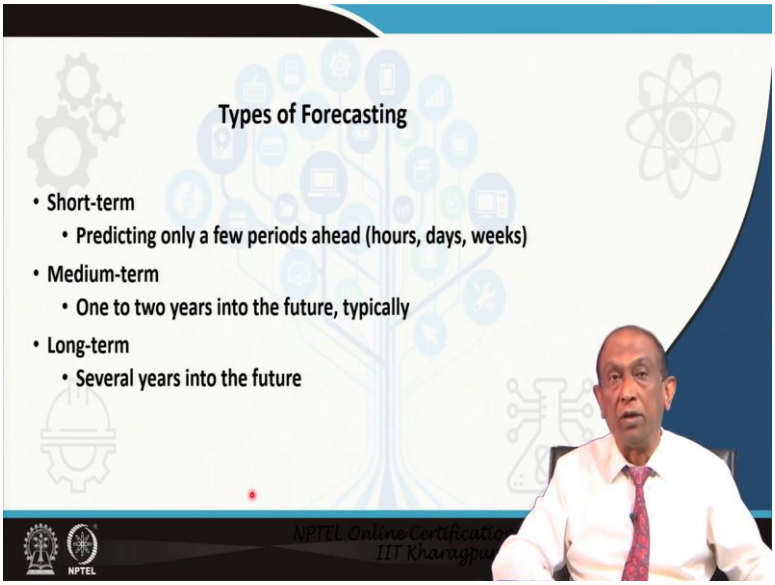

Now, let us look into the different types of forecasting, when we talk about different types of forecasting very popular is and maybe at times much more accurate compared to other classes is a short term forecasting. Short term forecasting refers to predicting only a few periods ahead for example, the time horizon is in terms of hours, days, weeks or even months.

Medium term forecasting refers to the cases where one to two years into the future we are looking ahead and long term forecasting is difficult here more than qualitative a more than quantitative techniques, qualitative forecasting techniques are used because the planning horizon is large several years into the future and hence the chances of forecast

errors is more compared to the cases where we are doing short term or medium term forecasting.

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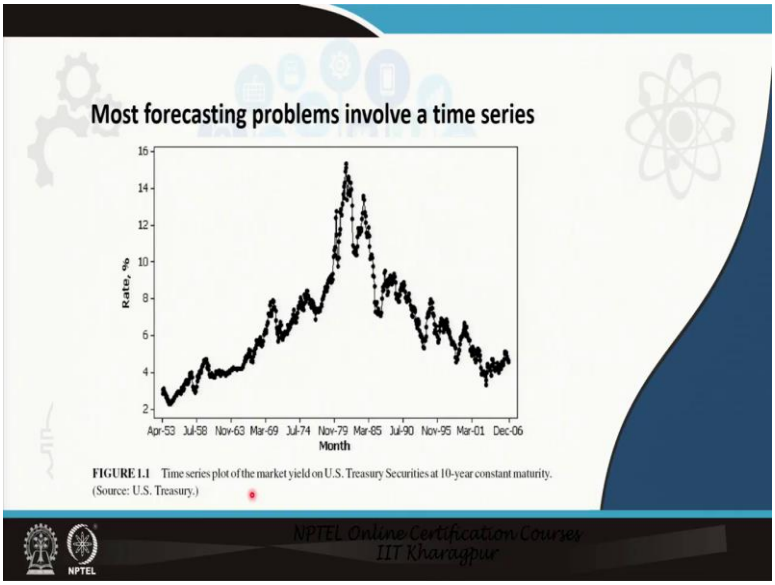

In cases of short term and medium term forecasting mostly quantitative techniques are used and most forecasting problems they involve a time series. What is the time series? Where the particular event the data related to an event is plotted over a period of time.

So, you will notice a pattern as represented in this slide, over a period of time maybe say the event is fluctuation of sales or demand for a particular commodity, how it is fluctuating, how it is varying that comprise a time series.

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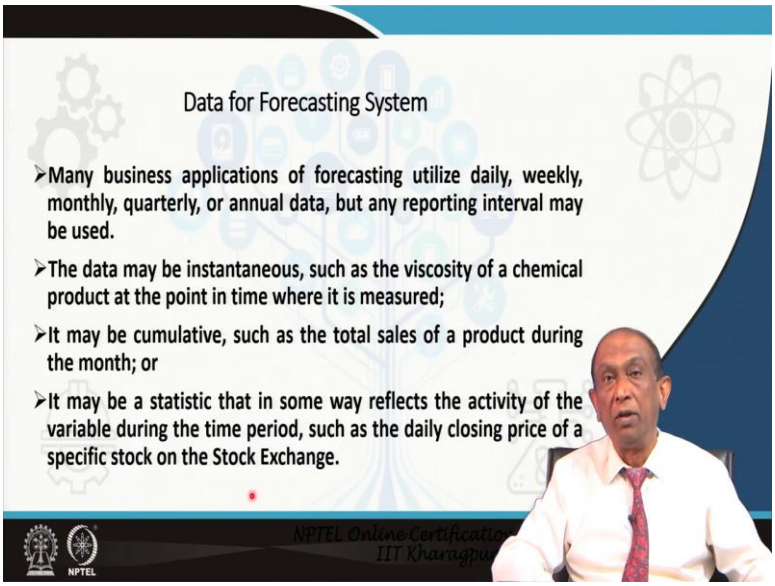

Many business applications of forecastings they utilize daily, weekly, monthly, quarterly or annual data, and reporting interval may be anything. The data may be instantaneous such as the viscosity of a chemical product at a point in time when it is measured.

The data related to forecasting system may be of cumulative nature, such as the total sales of a product during a month; or. The data may be a statistics that in some way reflects the activity of the variable during a time period, such as the daily clothing price of a specific stock on the stock exchange.

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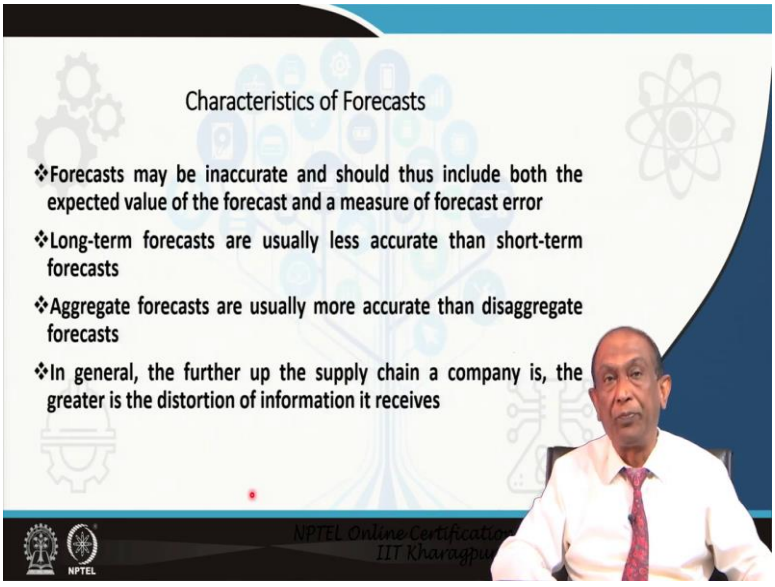

Characteristics of forecasts; forecast is a forecast. So, forecast may be inaccurate and should thus include both the expected value of the forecast and the estimate of the error involved in that which is quantified by a measure of forecast error. We should keep in mind that long term forecasts are usually less accurate than short term forecasts.

Aggregate forecasts are usually more accurate than disaggregate forecasts. What is the aggregate forecast? Say for example, you club the demand for similar products together and then as a family you predict the demand for that group of products I am aggregating, if you do that then it is much more accurate compared to forecasting individual parts.

Again in a supply network or a supply chain, the further up the supply chain a company is the greater is the distortion of information it receives, which in supply chain management gives rise to a phenomenon called the bullwhip effect which we will discuss in a subsequent module.

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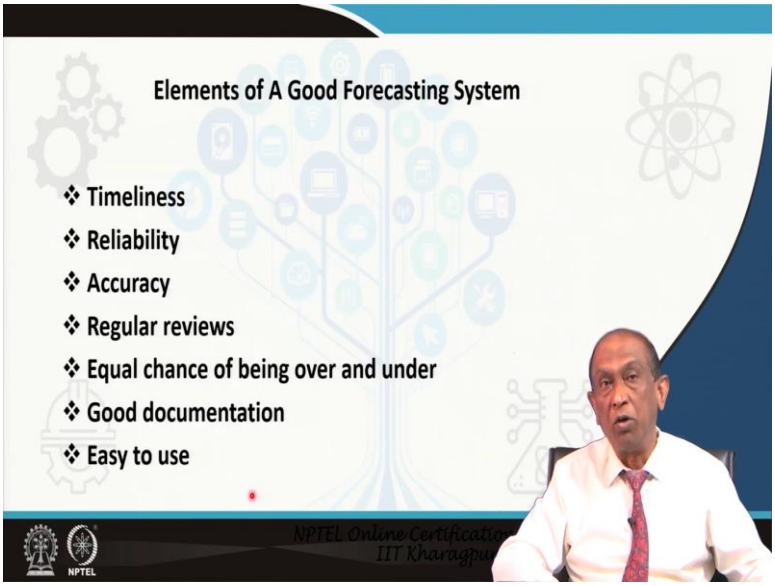

When you look at the elements of a good forecasting system timeliness, reliability, how consistent is the forecast, accuracy of forecast, these are very important. Whether the forecasting system undergoes regular reviews, whether the forecasting system is comprehensible and easy to use, whether there is a good documentation associated with the methodologies that are involved, how to use the forecasting system, all these things are very-very important.

So, when designing decision support systems for forecasting these points also must be kept in mind.

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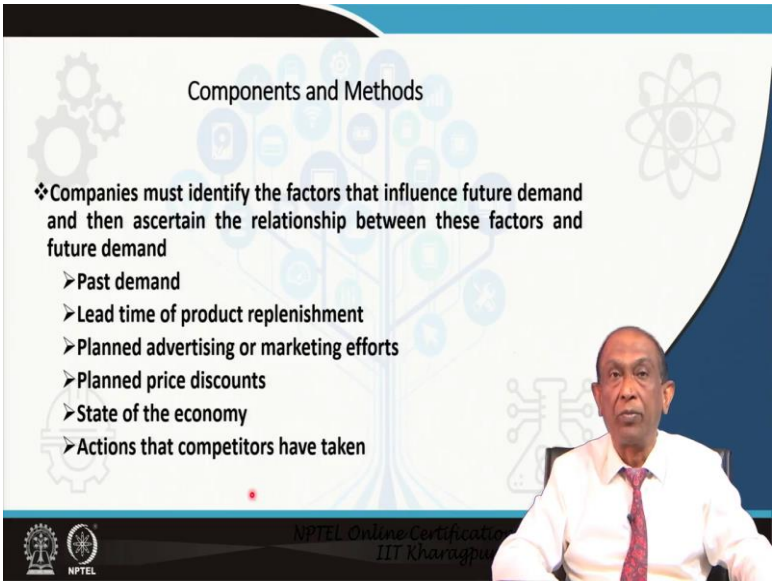

Again companies must identify the various factors that influence the future demand and these factors play a very important role in forecasting the demand for any entity. What are these factors?

For example, past demand of the products, lead time for replenishment of products, planned advertisement or marketing efforts that have been put in, that will also influence the demand for products. If companies are offering price discounts then also it will affect the demand for the products, the state of the economy, the other competitive actions taken by the rivals of a company, that also affect companies demands for products.

So, you see only quantitative techniques may not help in accurately forecasting the demand for products and hence it is a semi structured kind of problem, where the solution procedure partly takes care of the problem and it has to be complemented by managers experience intuition and judgement.

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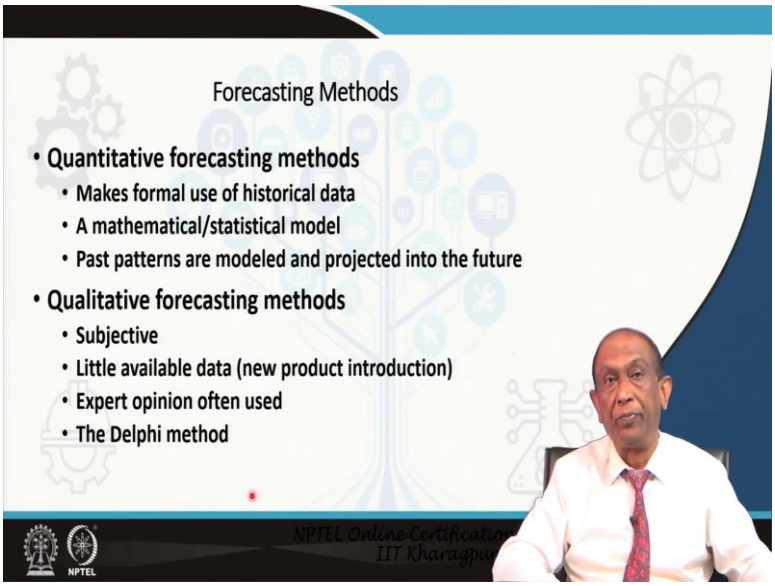

We have already mentioned that in every decision support systems there will be a model and there is manager to computer interaction. Managers will interpret the model output and might change various input or can adjust the output. So, forecasting methods plays the role of models particularly these quantitative forecasting methods, which makes formal use of historical data.

There is a mathematical or statistical model and while these past patterns are modeled and projected into the future there is a very important underlying assumption that the past trends are going to continue over the future. If that assumption is violated then this entire quantitative forecasting technique will go wrong.

Qualitative forecasting methods are used when we are going to do forecasts over a longer period of time, particularly say for strategic planning problems or even for unstructured decision making situations. So, qualitative forecasting methods there is lot of subjectivity involved in that there may not be any past data related to such kind of forecasts.

For example when we are going to introduce new products, no data exists related to the demand for that product. So, here is the very challenge very complex challenge and lots of techniques which are widely deployed belongs to this category of qualitative forecasting methods when new products are getting introduced.

Various kinds of knowledge management systems have come up expert systems are being used even experts opinions are captured for qualitative forecasting and one of the popular methods for qualitative forecasting is the Delphi method.

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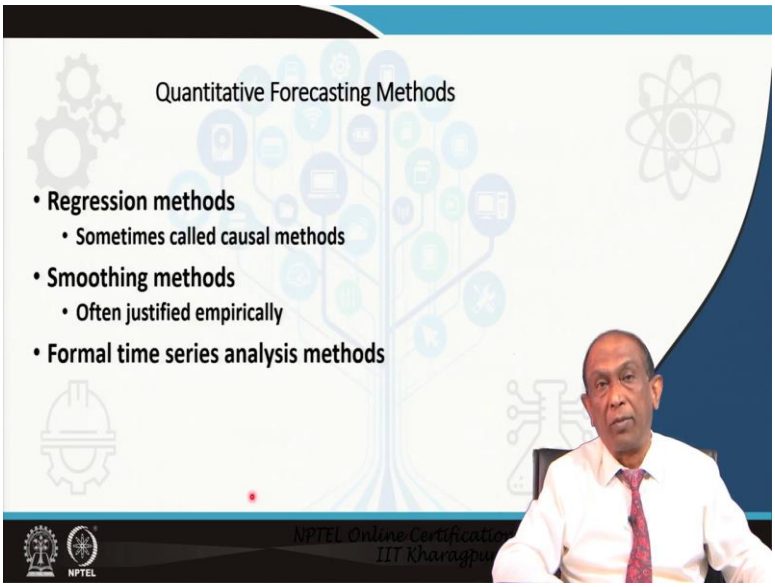

In the domain of quantitative forecasting methods we have regression techniques which are sometimes called the causal methods, smoothing methods they are often justified empirically and there are formal time series analysis methods.

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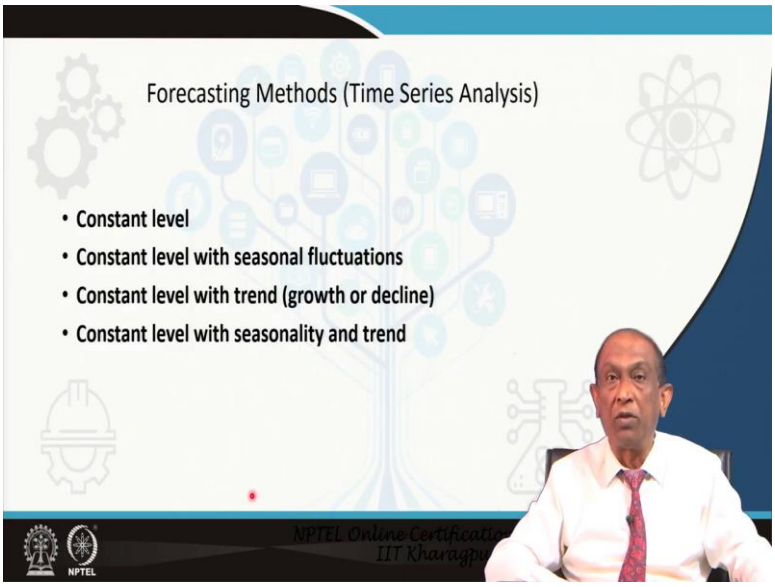

So, when you look at this time series you will observe that every time series has got an expected value or a mean value which is basically referred to as the constant level. There can be random fluctuations around this constant level of this mean there can be random fluctuations around the mean along with seasonal fluctuations.

There can be a situation where there is a constant level with trend either in the upward direction or in the downward direction and there can be mix of everything that is mean with random fluctuations we trend and along with seasonality. We will talk about various techniques to take care of this.

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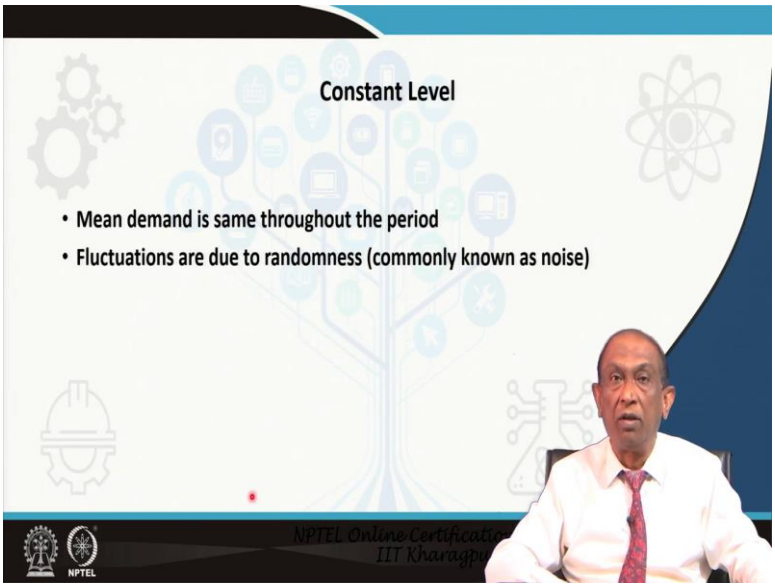

So, constant level is a situation where the where the average demand or the mean demand is the same throughout the time period over which we are going to study the time series. And there are fluctuations which are random over this mean and these random fluctuations over this average level of demand, over this particular time period of study is sometimes referred to as noise.

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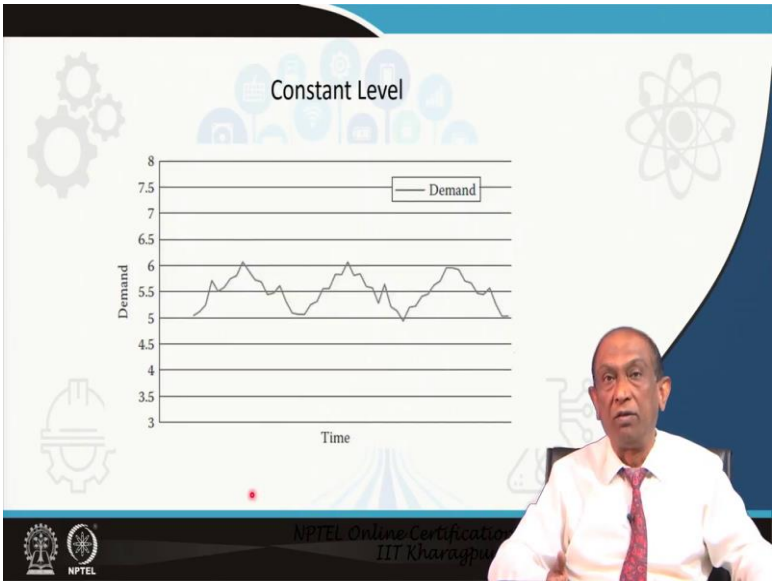

This is a picture of constant level.

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If there can be a seasonality superimposed on this constant level, you see there are seasonal peak, then down crest and troughs.

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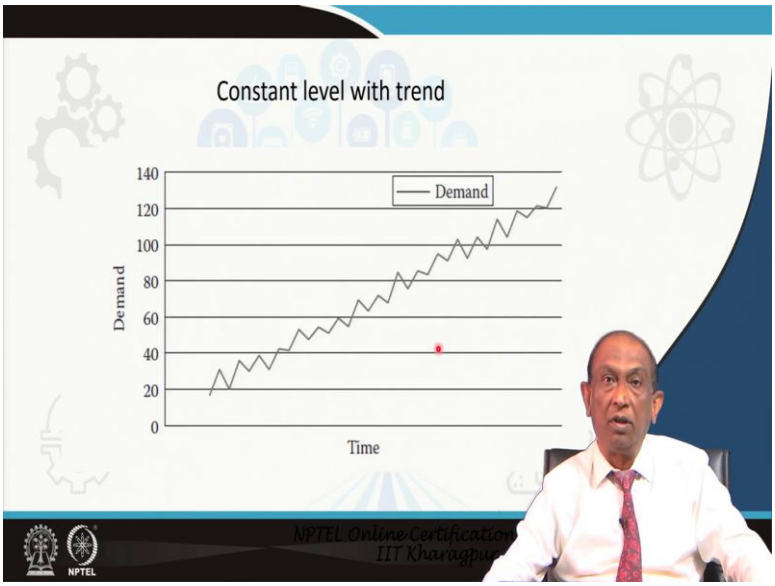

Here, there is a constant level with trend.

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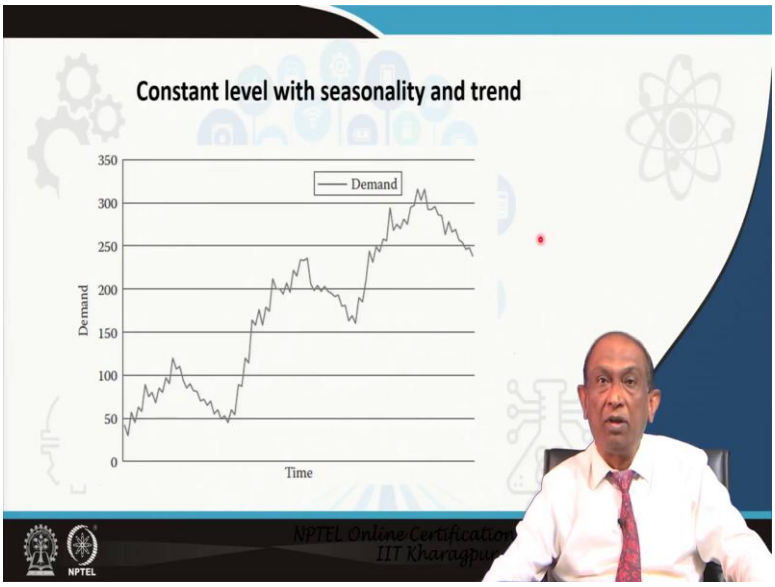

Here you see a constant level with seasonality and trend; everything is there.

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This is the reference book that has been used for preparing this first module.

Thank you all!