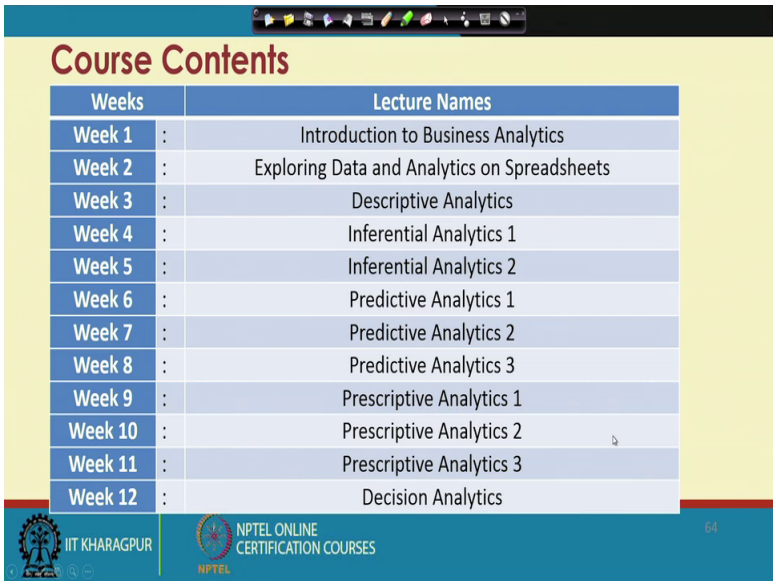
Business Analytics for Management Decision
Prof. Rudra P Pradhan
Vinod Gupta School of Management
Indian Institute of Technology, Kharagpur

Lecture – 04
Introduction to Business Analytics (Contd.)

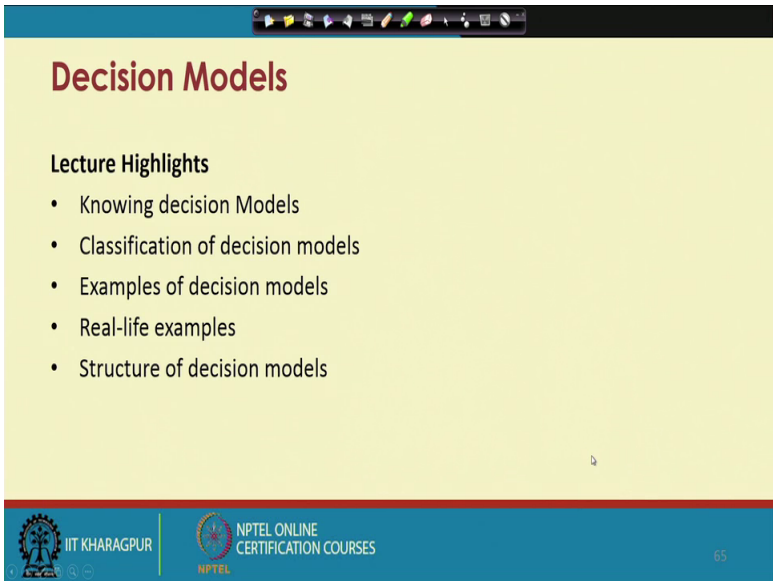
Hello everybody, this is Rudra Pradhan here and welcome you all to this lecture, today we will start our fourth lecture of the series in that to introduction to business analytics.

(Refer Slide Time: 00:30)



This is the course contents so we are still in week one that too introduction to business analytics and that too 4th lecture of this series.

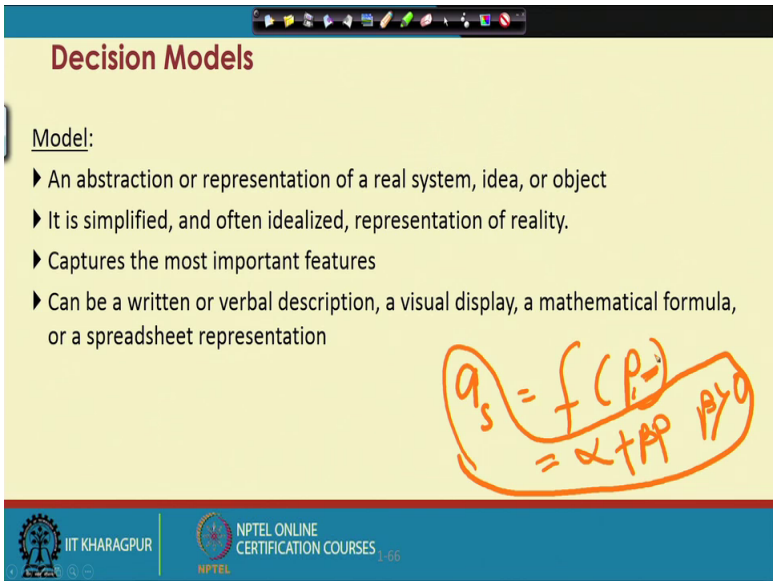
(Refer Slide Time: 00:42)



And let me start with the lecture highlights today and we are going to discuss the concept called as decision models. Since this subject name is called as a business analytics management decision. So, we should know actually the concept called as decision models.

On the basis of you know decision models. We are in a position to take some kind of management decisions so accordingly. So, today's discussion will be knowing decision models, then second one is the classification of decision models some examples relating to decision models then some of the real life examples and structure of decision models.

(Refer Slide Time: 01:29)



So, first of all what is actually the models. So, we are living in a life real life scenario and the problem and this environment is very complex and very difficult to analyze. And with the help of you know models we can actually simplify the particular structure and we may be in a position to solve some of the management you know decision problems or we are in a position to take some decision, which may be very effective and attractive.

So, first of all what is exactly the concept model? It is an abstract of aerial systems or idea or an object. So that means we like to summarize the particular structure into effect right. For examples, let us say in supply creates a you know on demand or supply you know is a function of price or in other words supply can be decided on the basis of price factors or demand can be decided on the basis of price factors.

So, the simple strategy will be like this, other things remaining constant price and supply can be positive related to each other. So, this is a kind of statement. Now, if you like to actually transfer into model format, then simply you can write you know quantity supply is equal to function of price right. So, this is how you can simply right and this is a kind of implicitly format and if you like to put in a explicit format, then it can be alpha plus beta P.

Now, if you will put beta greater than equal to 0, then the entire you know models can be recognized as you know the kind of law of supply, where you know the structure is the other things remaining constant, price decides the quantity supply. Other things remain

constant means we are just putting a P, there may be some other factors which can also affect the quantity supply. But since we are not taking care of you know other factors then quantity supply can be influenced by P, and instead of saying actually long statement, if you simply actually put a equation that is you know transfer with in a particular mathematical format, then by default you can interpret the same message.

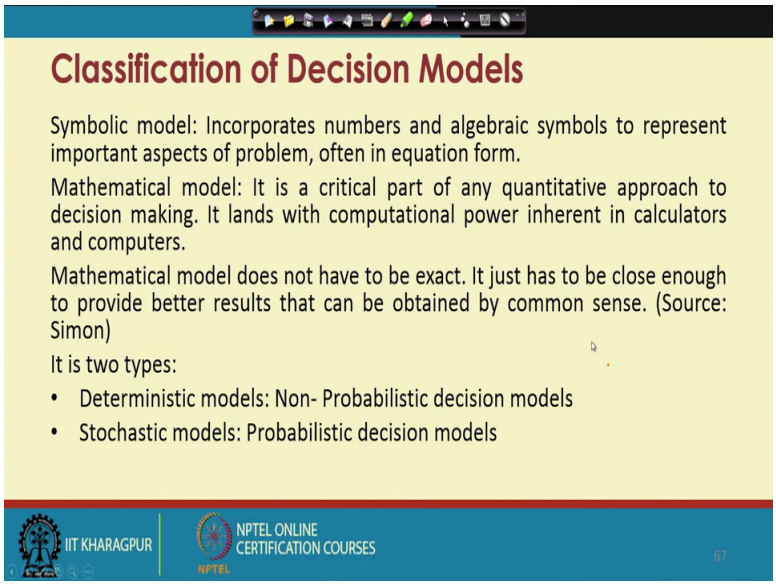
So, this is how the beauty of the understanding of you know concept called as models. So, the definitions says that you know it is simply an abstract of you know ideal life system or you know some kind of object or some kind of fact. So, like the example which have sited. The other way you can also mention that other things remaining constant, quantity demand and price are inverse related to each other, this particular can be developed where the slope coefficient can be taken you can put like you know less than equal to 0.

So, that itself will give you the signal of this particular definitions right. So, what should be the actually nature of these models? It should be simply, it should be very simple and it should be very ideal and can represent the reality or you know it can give some kind of better inference and a better best kind of measures.

So, capture the most important features model can represent important features or you know can represent a kind of important facts. Can be written or it can be verbal descriptions or it can be a visual display, you know it can be a mathematical formula or it can be a spreadsheet present a presentation. Like you know, this is excited highlighted here. This is simply you know mathematical formula, but it will visualize something the reality.

So, instead of saying you know big statement, we are putting a particular equation, and that equation itself will interpret the particular concept which you like to transfer its like to communicate. So, that is how the beauty of this kind of decision modelling process. So, we in order to go you know better understanding about the models. So, I will give you some kind of structures.

(Refer Slide Time: 06:13)



So, the structure starts with you know this classification of you know decision models. So, we have actually, we have here classification like you know model can be divided into two parts, it can be a symbolic model and it can be also non symbolic models, right.

Symbolic models, incorporates numbers, and algebra symbols to represent important aspects of the problem, and it maybe sometimes called as equation for form. But generally when you will call it as models, most of the occasions the understanding is that it is the kind of symbolic representations. So, this because this will this sometimes you know beauty of this particular modeling environment, and so one particular models we called as mathematical model and another particular model is called as statistical models.

So, here in this kind of making process we will be dealing with some kind of mathematical model, and that is why we first understand; what is the mathematical model concept all together. So, mathematical model in general critical path of any quantities approach to a decision making process, it lands with the computational power inherent in calculators and you know computers.

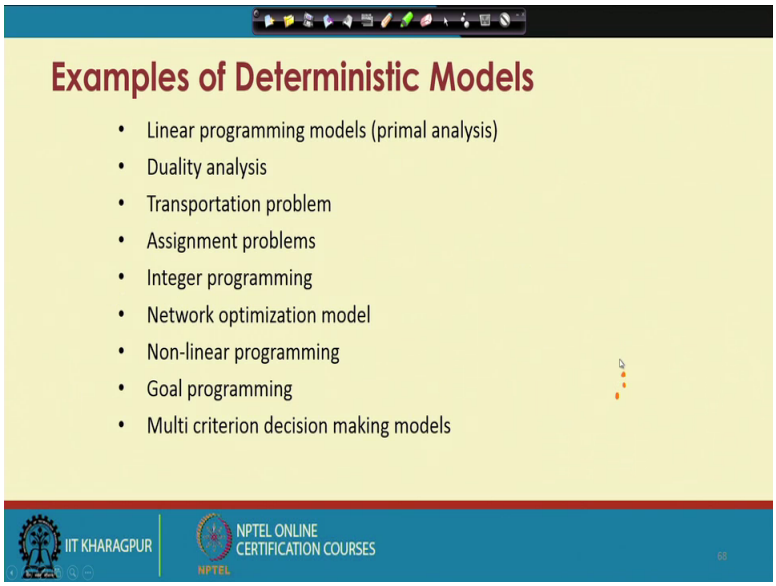
So, in another way you can represent like this mathematical models does not have to be exact. It just has to be close enough to provide better results, better inference and that can be obtained by you know simply kind of common sense. This we know which we derived from the definitions from the Simon. So, generally model can be divided into 2

types deterministic models and stochastic models, the difference between the two depends upon the probability the connection of you know probability.

So, the deterministic models usually called as non probabilistic decision models and stochastic models are called as probabilistic decision models. By the way so these are all called as decision models. So, technically all the decision models can be a either actually deterministic type or you know stochastic types. So, deterministic types is easy to handle, but you know stochastic types it is not actually easy to handle, because some kind of reason uncertainty will be attached with this you know non stochastic kind of modeling environment.

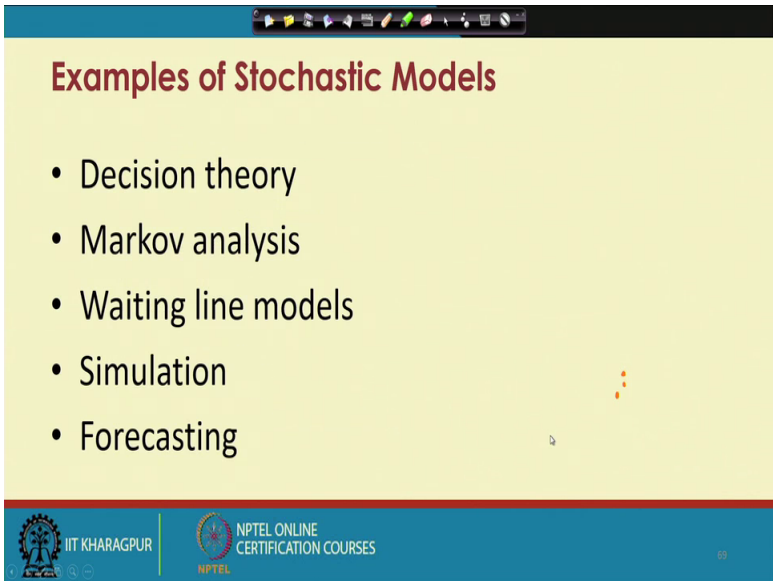
So, we have to deal with you know understanding our about these two models, and then will go in depth kind of examples ok.

(Refer Slide Time: 09:12)



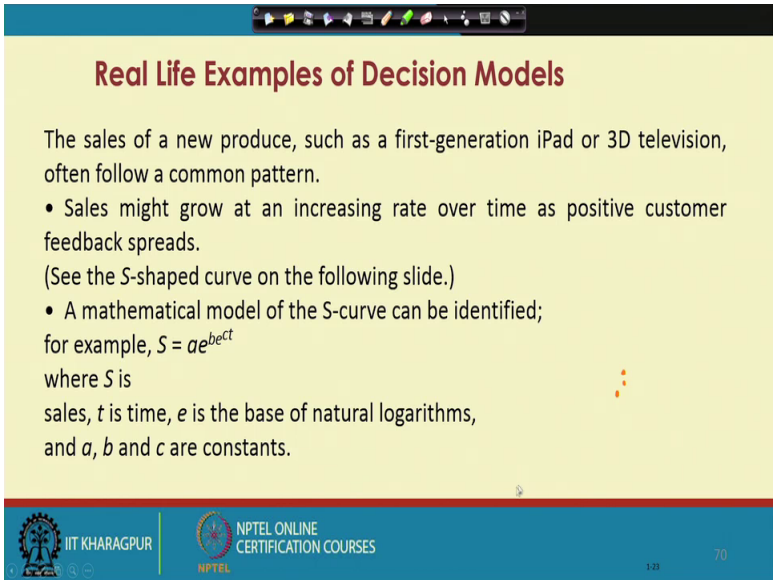
So, since have already mentioned about the cluster of the decision models, that is deterministic verses stochastic. So, we have actually plenty of examples. So, in the deterministic models the examples are LPP that is the linear programming problem models that too primary structure, then the counter party is the duality structure, then we have transportation problems, we have a assignment problems, we have a integer programming, network optimization model, non-linear programming, then goal programming and multi criteria decision making models.

(Refer Slide Time: 09:57)



In the other side and the other side under this stochastic kind of modeling you know environment we have a decision theory, Markov analysis, waiting line models simulation and forecastings, right. So, these are you know two different cluster all together of course, as per our requirement of this particular subject. We will touch a couple of genesis models right as per the particular business problem and a particular business applications.

(Refer Slide Time: 10:23)



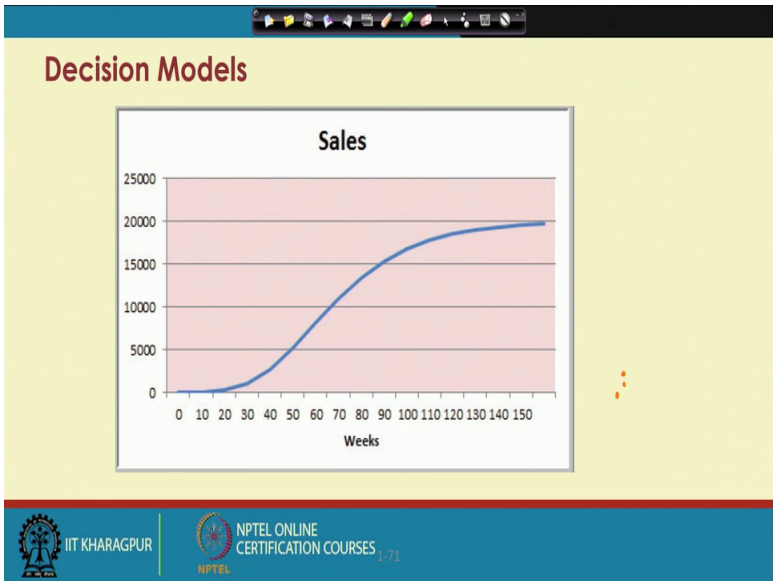
Let me give some kind of real life examples here. So, the examples actually see the fact is that you know sometimes you know it is it to a process all together, and we may actually develop a particular model and then we like to test where it can be applied. But sometimes the counterpart is also true, where we have actually information and on the basis of information, you can develop particular models.

That means, technically since we have already mentioned model is nothing but you know some kind of abstract of the reality. And that means, technically what can say that you know there is a simple equation, which can actually be treated as a particular model and that equation itself will gives lots of you know message or you know interpretation as per the business requirement. And using the particular equation you can get some kind of management decisions or you can you know you can get you know better inference to you know to predict certain kind of business requirement.

But the thing is that you know you must have a data and with the help of you know data you can plot and then get some kind of trend and by using some kind of tools analytics tools then the data can be converted into a particular models maybe, may be simple you know particular equation through which that equation can be helpful for you know analyzing the reality or the position through which you can you know take a management decisions the sited example is here.

So, it is the kind of sales forecasting and that too with respect to time sometimes what we have already discussed earlier that you know we have a structure called as predictive analytics; so the use of predictive analytics or any kind of predictive analytics tools. So, you need actually the kind of past data. So, once you have a the past data using the past you can you know you know find out you know trend or you know checking the kind of past data you can build a particular functional form for simple example you just plot it like this you know this is actually s type cor.

(Refer Slide Time: 12:49)



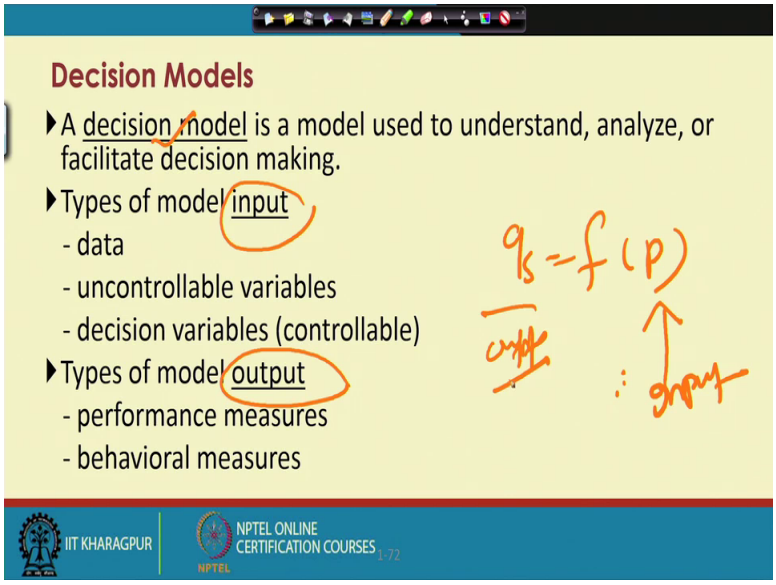
Let us see here this classic example is a just we have a here a sales data and that too weekly basis. So, this sales data can be also day wise, can be also month wise, can be also annually, but actually here as per the requirement. So, we have actually weekly data and then the once you plot all these you know then you will find the actual trend and on the basis of this trend. So, you can actually fix a particular functional form right.

So, there are you know there are there are many different ways actually you can detect the particular functionality. So, regression is one of the one of the search techniques through which the information can be means data can be transferred into a particular mathematical equation and that equation can be useful for any kind of further prediction or any kind of decision making process. That means, what can say that you know. So, with the availability of data or the kind of structures you can prepare actually models that is what we called as decision models once you prepare a particular decision model, with the help of you know you can you can predict the future and then you can take them in you can go for some kind of management decision.

But actually it is not easy to develop a particular model until unless you have clarity on you know theoretical part; that means, the understanding of this problem and the a, the kind of availability of data, if the information is not readily available or the theory is not so good or your understanding is not clear then the exact structure of the model cannot be quantified properly or it cannot be prepared properly.

So, once you prepared actually the decision models as per the particular problem structure and data structure then you are in a position to take a decision and then you are in a position to predict as per the business requirement.

(Refer Slide Time: 14:58)



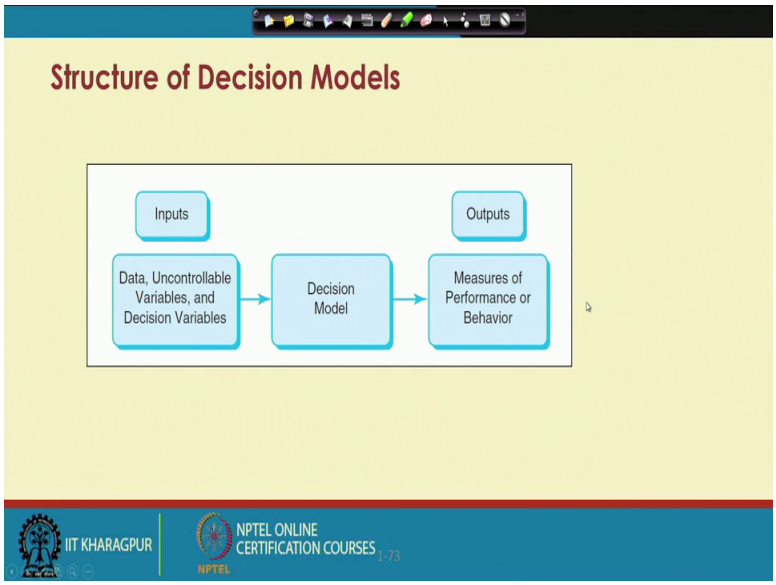
So, decision model you know decision model is a model used to understand, analyze and it can facilitate to take a decision making, that too you are supposed to actually take a decision that is what we call as actually management decision. So, what will you do that you know you develop a models and that model itself will create some kind of insights or inference and then on the basis of that inside and inference you are supposed to take some kind of decisions. So, basically so here so we are in a discussion about the decision model. So, there are 2 items in the decision models one is called as inputs, another is called as actually output right.

So, usually it is the game between input and output. So, when we are actually like you know previously have right actually supply equation or you know demand equations like you know simply qs equal to function of p like this then here. So, this is a kind of input process and this can be called as output process, but how they are you know actually linkage. So, that will discuss actually in the later stage this is act this is this is input and this is output unit. Now, you know it is the game between input and output the types of models so for the input is constant. So, data uncontrol, variables and the decision variables right so; that means, some are you know in control and some are not control.

So, still you know you are you are in a, you are in a process to prepare the model, design the model and you know take the take the decision accordingly. Technically so when you are building a model definitely you have some kind of flexibility or some kind of control and you may not have some kind of control, but always you try to prepare models in such a way that maximum control maybe in your hand. So, that you know the prediction can be good or you know the decision you can make in a proper way.

So, the other side, the types of model is you know output based and that too to check the performance measure and behavioral measures that is like you know this is the classic example this is actually output side and this is the input side. It is a simple kind of examples, but you know there are there are you know lots of complex models depending upon the situation, depending upon the problem, depending upon the variables involvement, depending upon the constants, depending upon the objective functions the kind of conflicts. So, many things will be there on the basis of that we have to take a decision right.

(Refer Slide Time: 18:04)

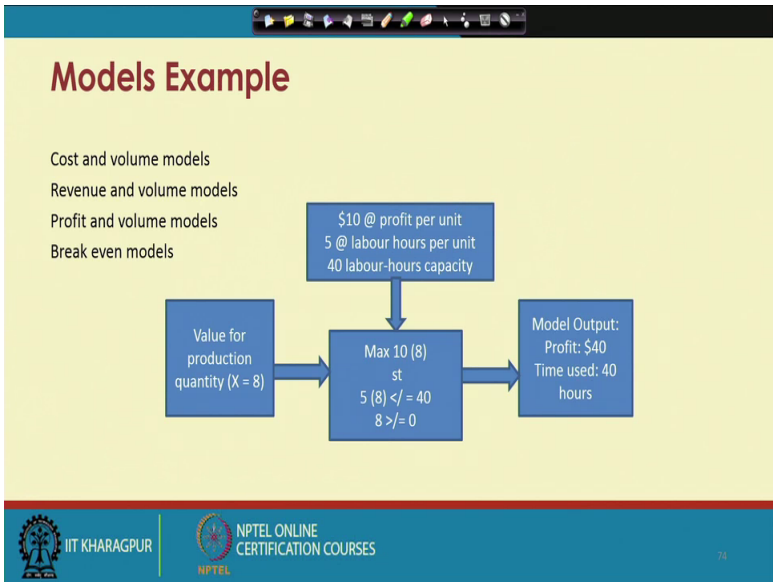


So, the typical structure like this. So, what we have mentioned earlier that you know in the decision models we have a 2 parts, one is called as input side another is called as output sides and generally if you link like this then you know it is the game between you know dependent variables and you know independent variables. And then output is nothing but called as dependent variables which can you know predict or measure the

performance and the behavior kind of things and then the input sides is called as technically called as independent variables, which may be data then the variables may be controls non controls and some kind of decision variables. And then finally, we have actually the decision making you know models.

So, the model itself will you know connect the inputs and you know give some kind of message to the output for example let us see here.

(Refer Slide Time: 19:00)



So, this is actually typical example simple example and here, it is the kind of profit you know profit analysis. So, the profit is the difference between revenue and cost and revenue cost both are you know depend upon the price and quantity structure and we have a kind of breakeven models. So, break even models like is this total revenue equal to total cost, but you will check here actually whether it is actually break even or actually something more than that or something less than that.

So, here this is actually value of productions let us say x is a kind of production unit and total production quantity is 8 in number and it is actually processed through you know some kind of inputs, that is actually labor inputs and in this particular case we are fixing with respect to labor only then one is a labor input then there is a quantity that is the product.

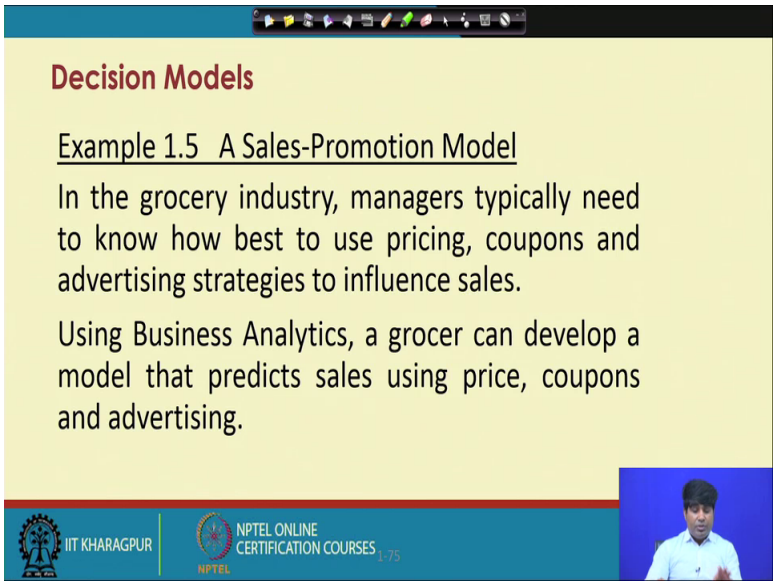
And then you know inputs and then outputs and then connect with actually the pricing. So, you will finally have some kind of not clear cut you know business decisions. That means, so when what is actually the business model all together here. Now, the business is actually you are going to produce a particular product that is a nothing but collagen x and you are going to produce actually x in 8 numbers and then that to keeping you not having keeping the mind that you will be having profit per unit actually a dollar tens and the input sides.

So, you are you know pay you are able to pay 5 dollar 5 dollar for labors and then labor abilities you know 40. So, accordingly the modeling structure will be like this, a maximize you know x subject to the labor constraints and then and the in equal in some kind of restriction for any for instance restriction is here that you know you are you are actually output cannot be a kind of negative that is why we are putting actually x greater than equal to 0.

So, as a result the model output will be profit. So, the profit actually fix actually 10 and that to the way you are you know linking 5 for you know 5 units and then and the particular structure about the, particular structure about the product. And finally, your profit outcome will be 40 and then times use will be 40 so; that means. So, you if you are fixing actually 5 in 5 into 8 and a that is actually maximum use it actually availability of 40 labors then the business will be produce actually 40 dollar profit.

So, this is how a simple kind of an understanding you know so far as a management you know decision is concerned and you know decision models are concerned.

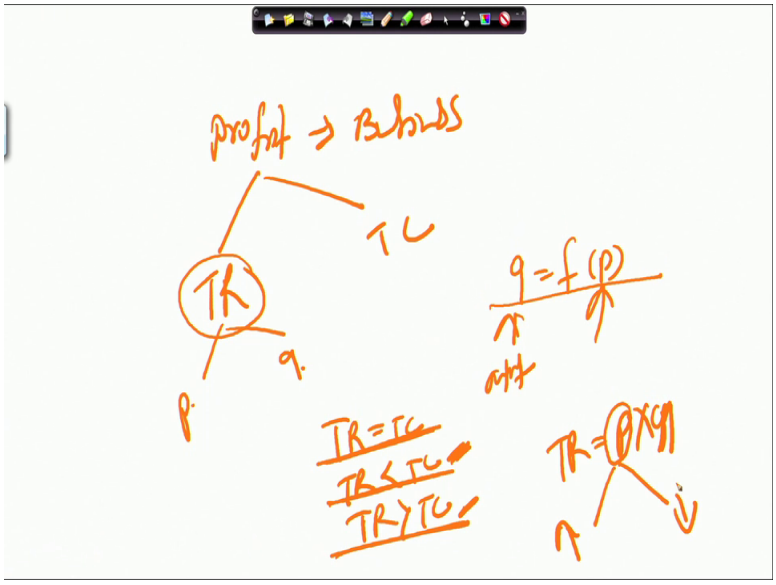
(Refer Slide Time: 22:19)



The some of the examples like you know let us a sales promotion models in the grocery kind of in our industry managers are typically need to know how best to use pricing coupons and advertising strategy to influence sales using business analytics a grocery can develop a model that predicts sales using price coupon and advertising.

So, it is actually a simple kind of structure through which actually model you know model can give you some kind of prediction for instance. So, let me give a hint actually here so usually actually in a real life scenario, a real life scenario.

(Refer Slide Time: 23:03)



So, you know profit is the prime objective of, you know profit is the prime objective of any kind of business any kind of business. So, here is so profit depends upon 2 things. So, this total revenue and total cost and total revenue typically depends upon you know price and quantity right. So, that is actually total revenue is you know you assume that it is kind of sales revenue.

So, now let us say cost is constant and you are in a position to or you are in a position to highlight that you know how profit can be optimized here or profit can be maximized here, then with the help of you know price and quantity decision. For instance previously we have discussed a concert colors quantity usually depends upon price. That means, price is the input and quantity is the actually output.

So; that means, any change of price will affect your quantity. So, then price into quantitatively will give total revenue for instance the game between total revenue and total cost will be like this. So, TR equal to less than TC and TR greater than TC so here. So, this is called you know breakeven profit and this is called as low situation and this is called as profit situations.

So, now have to take a management you know you have to go for some kind of in a management decision when you are here is, but when you are actually here typically. So, here total revenue g less than equal to total cost. So, typically how you know or you can transfer this particular loss making unit to profit making unit the idea is that you know. So, how the decision model can help you lot or to or to go for some kind of management decision. For instance here q equal to function of p, that means, if am fixing your model like this then how the decision variables can you know influence your profit structure or you know business structures.

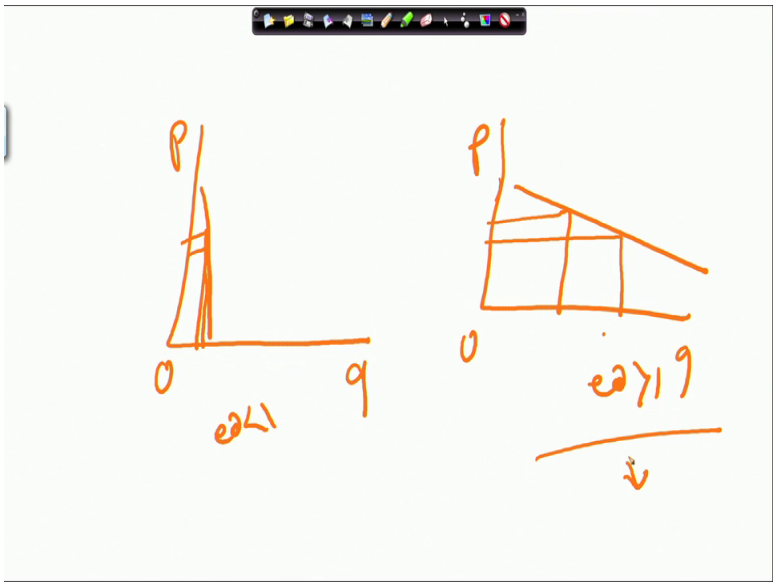
So; that means, it typically depends upon you know what is the business environment you are you know following. So, so whether you know you know or total revenue typically depends upon you know price into quantity so; that means, that means, here technically q is not in your control pg in your control. So, now, any change of p then q will change. Now, so if you like to change the pu p in order to get more total revenue in order to get again more profit. So, you have a 2 different policy altogether either you go for price increase policy or you know price decrease policy.

So, now, so whether you know you like to go for price increase policy or you have to go for you know price decrease policy. So, now, it depends upon actually a particular situation. So, now, with the help of you know with the help of actually with the help of particularly a kind of information. So, you should actually take a decision whether you will go for you know price increasing policy or you know price decreasing policy, it cannot be a arbitrary kind of choice.

Now, you plot these kind of informations and then you build your model, the model itself will give a signal whether you like to you follow the increasing price policy to get more revenue and we will give you more profit or you can go for you know price decrease policy that can also increase you know revenue and then that that really take you to again more profit.

So, ultimately in this particular game this is called as actually market models all together in a kind of in a business environment this completely market model and here whether to go for price increase kind of in a situation or price decreased kind of in a situation ultimately did it depends upon it depends upon you know few things you know pricing you know few things means it is typically actually the kind of elasticity concept, depending upon elastic change is change situation then you have to take a decision. So, there is a concept in this you know business in environment with respect to this pricing cologne price elasticity, the price elasticity can be more or price elasticity can be less.

(Refer Slide Time: 27:40)



So; that means, typically it will be look like this. So, let us take an 2 examples here is you can when we will plot like this then this will be quantity and this will be price and this will be quantity and this will be price. So, will give you two different environment here this will be like this and this will be like this. So, this is called as actually ed you know less once and this will be ed e greater one this is called as a more elasticity and this is called as a less elastic.

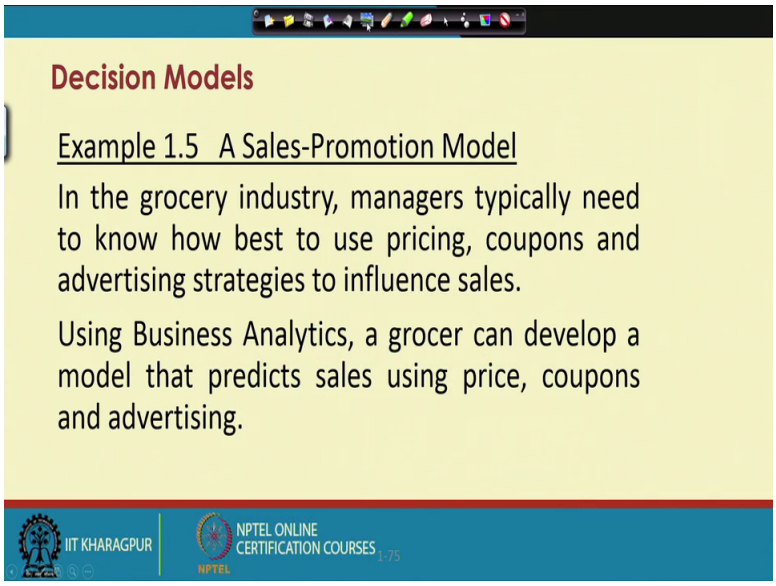
So, here he here you have a different kind of price effect or price structure and here you have a different right kind of know price structures. See any change of price can change the quantity, but if you look this particular structures let us say this is the original price, now any decrease your price will have a large change of you know quantity. So, now, here it is the original price and any change of small price will not largely affect the kind of quantity.

So, now in this case in these particular situations if you actually increase the price then your quantity structure will not change drastically; so as a result in this kind of an environment. So, you have to go for you know increase price policy, but in this case if you decrease a little bit you know price then you have a large change of you know quantity. That means, in this case your price strategy should be a you know lowering the price in order to have a more revenue more profit and in this case in order to have a more revenue and more profit we have to go for you know price increasing policy.

But ultimately it depends upon you know whether you are this environment or this environment. So, you cannot have arbitrary choice against with the availability available data you just plot it model it then it is check the nature of this particular, you know relationship between p and q.

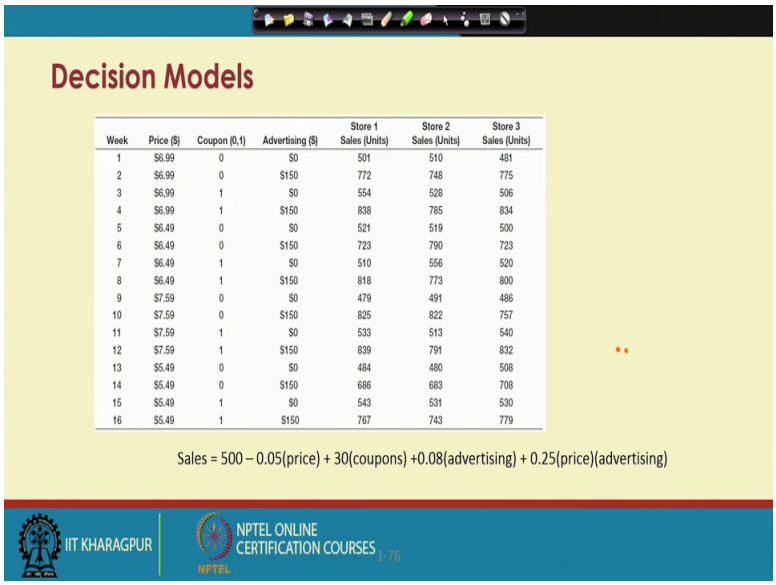
Ultimately in the spreadsheet you have a p information and q information with the help of you know qe if you and q information you build a model or you find out the functional form then the functional form will give you the kind of you know kind of an understanding or it will give you a kind of in a strategy through which you have to take a decisions, but until unless you have the kind of data or you know informations you are not in a position to prepare the model and then you are not in a position to take a good decision as for the particular requirement ok.

(Refer Slide Time: 30:03)



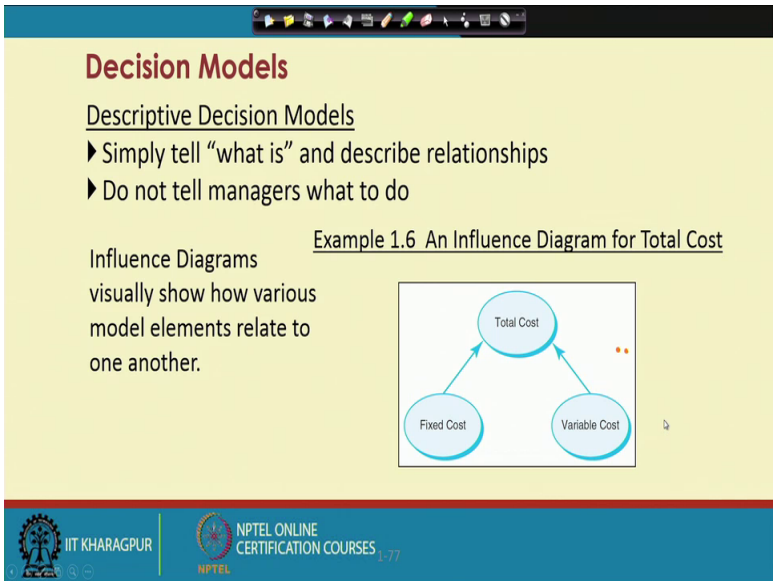
So, now similarly so there are plenty of such examples so these are.

(Refer Slide Time: 30:17)



So, what I have mentioned that you know you have actually all kinds of you know information with the help of you know information you can build your model. And then model by default will be summarized something or you know predict something as per your management requirement, ok.

(Refer Slide Time: 30:36)



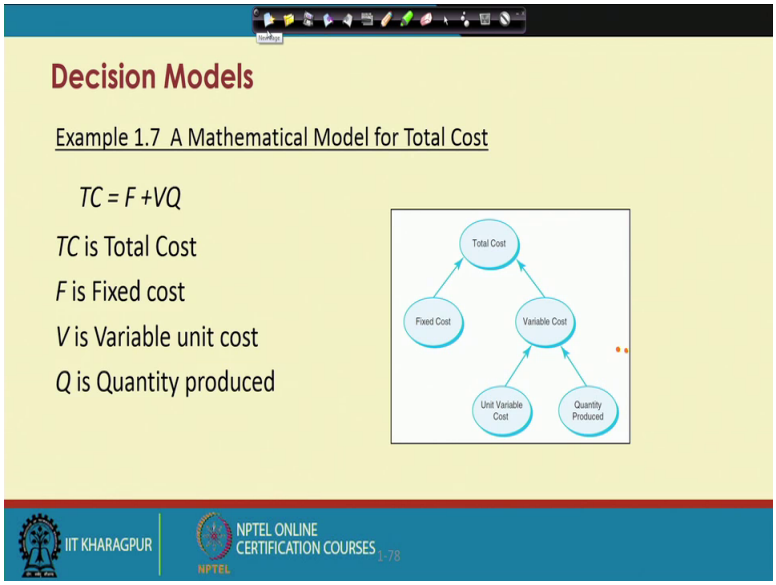
So, there is another kind of you know situations through which you know decision models can you know predict certain kind of environment. So, the previous example which I have cited is nothing but actually price and quantity relationship and this is a kind of model where you are going to take some kind of an action on you know costing right in a business kind of requirement. So, cost is one of the factor which can actually affect your business process drastically.

So, usually cost can be divided into fixed cost and variable cost, but ultimately your strategy should be how best you can you know minimize your, you know cost structure whether it is the fixed cost or you know variable cost. So, again there it cannot arbitrarily actually apply any kind of strategy. Again similarly similar to the previous case you have actually cost informations then we plot all these cost informations build your model then find out a particular mathematical kind of equations or mathematical model through which you can you can get some kind of inference or you can get some kind of strategy. So, that you know cost can be minimized properly.

So; that means, technically you must have you must prepare a decision model through which you have to take a decision and you cannot in a position to prepare a decision model or build a decision model until unless you have actually kind of data or you know information once you have a data and information on the basis of that you have to build a

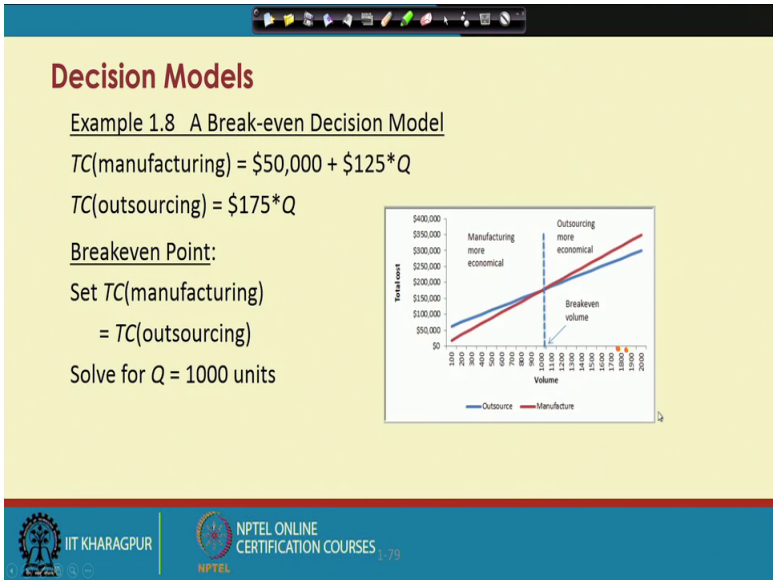
model and once you build a model. So, that model will give you some kind of inference as per your business requirement ok.

(Refer Slide Time: 32:25)



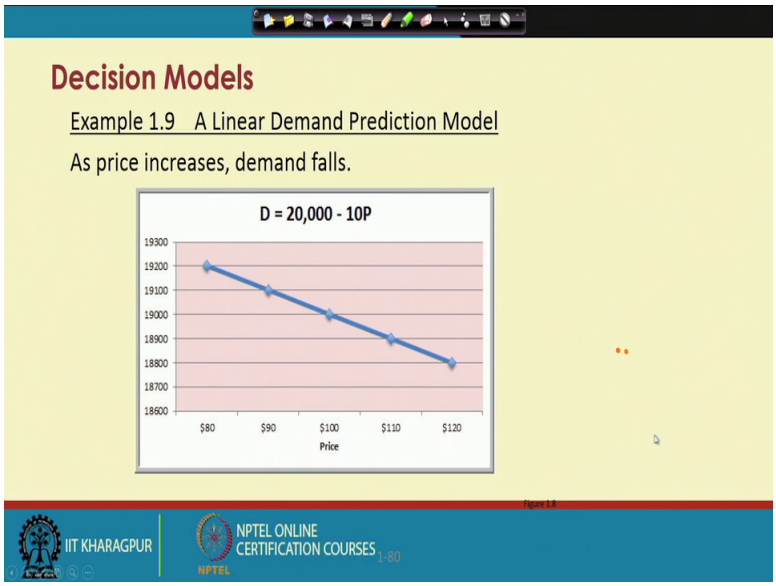
So, this is a little bit the extension about this you know previous model. So, you know you cannot understand reality. So, the variable cost can be again with respect to unit variable cost and quantity produced. So, then exactly you can actually follow up, but the whole idea is that how best you can actually minimize the cost particular structure because.

(Refer Slide Time: 32:48)



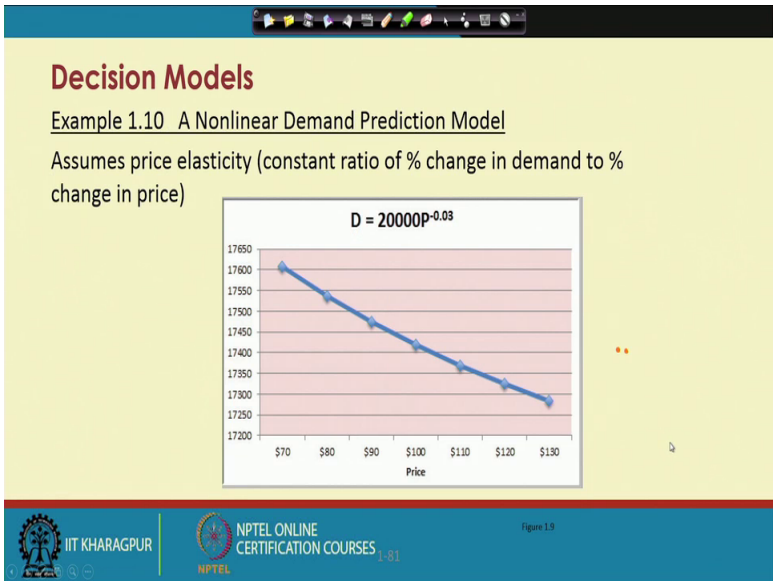
This is another kind of decision models typically break even analysis which I have already highlighted. So, with respect to total revenue and total cost; how best you can actually fix a kind of optimum situation. That means, actually sometimes you know your revenue will be not there, but you know with respect to cost situation or you know cost availability you can also prepare a model in such a way that this itself will give you signal how to reach the breakeven and how to reach the profit ok.

(Refer Slide Time: 33:27)



So, later on we will discuss with a particular examples and we will connect with you know some kind of management decision models, this is another kind of examples which you have already highlighted.

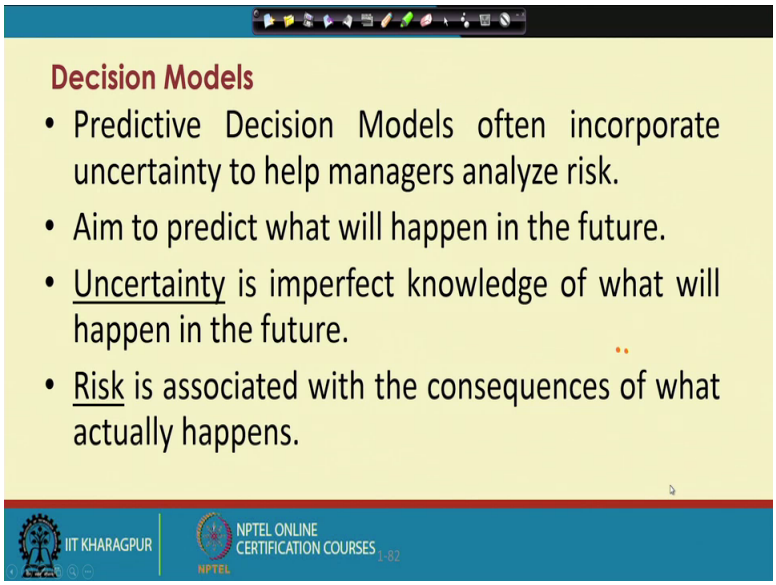
(Refer Slide Time: 33:30)



So, by the way decision models can be divided into 2 parts linear one and non-linear one, but by the way of whether it is a linear one and non non-linear one. So, it is not in your control. So, you know with the help of data you transfer into models and first you plot all these things all these data and then you can get to know the exact functional form and once you get a exact functional form on the basis of that you have to estimate the model with a kind of predictive techniques. And then you with the help of predictive techniques you will be get the parameters value, once you know the parameter values your model is ready.

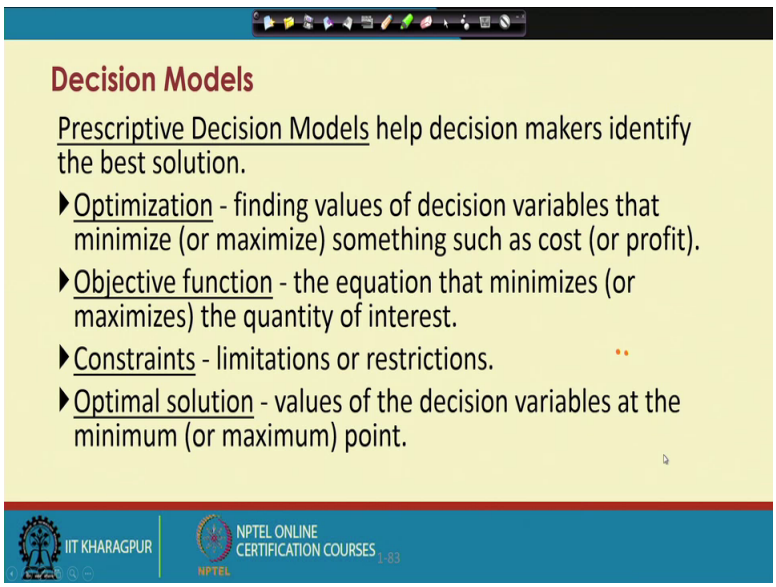
So, now that model can be used for some kind of management decision and then and that can be actually as per your business requirement right.

(Refer Slide Time: 34:26)



So, decision models you know part I particularly actually what I have mentioned actually sometimes you know some models are you know deterministic type and some models are kind of stochastic kind of stochastic kind you know nature. So, the differences usually with respect to you know decision and uncertainty in some of the management problems. So, addiction uncertainty, are in always in the doorsteps and you cannot just keep actually. So, while you not doing all these kind of analysis and in the process of decision making you have to take care all these factors before you proceed for any kind of prediction and you know management decisions.

(Refer Slide Time: 35:10)

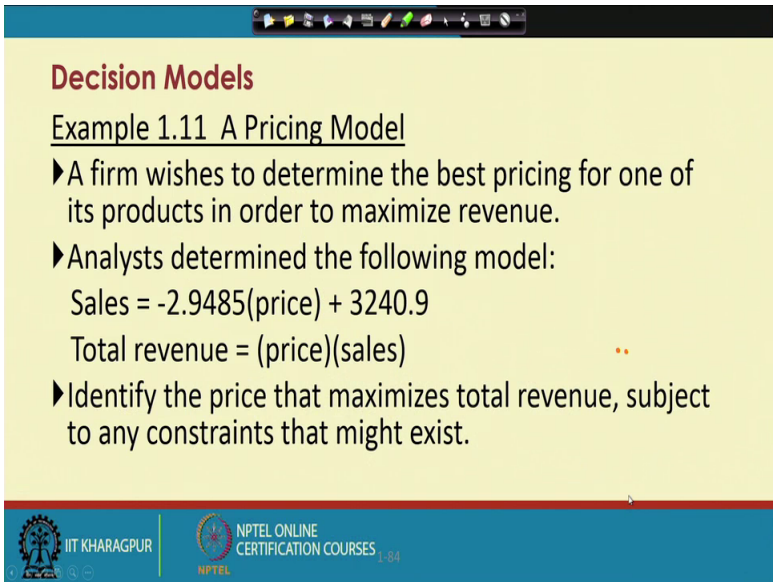


Usually decision models you know couple of things are very important. So, you know we are actually once you find out a models on the basis of you know data. So, you try to actually optimize it as far the as per the requirement. That means, we like to know actually the optimum values of the decision variables through which you can actually optimize your business structure whether it is with respect to profit or with whether it with respect to revenue or with respect to cost.

So, it is all together depends upon you know structure of you know objective functions and constraints right so; that means, technically. So, you have to build the you know with respect to the data availability you build your model and that model can be optimized to know the values of the decision variables through which you have to take a particular actions or decisions. And then you can optimize your business process. So, here actually you have to means this is actually the kind of structure called as a prescriptive analytics. So, it is actually connected from the predictive analytics because the predictive analytics will give you the transformation of data into the models then once you get the models.

So, you find out the possible constants behind this particular model then you like to now optimize the particular model subject to ability of constants and its dynamics then that itself will give the values of the decision variables where you can go for optimum decisions and that is that is what they actually a actual fact. So, far as predictive analytics is concerned and prescriptive analytics is concerned.

(Refer Slide Time: 37:03)



And some of the other similar kinds of models like this and you can go through all these details. So, this is a similar kind of problems and what I like to actually highlight here that you know in any kind of business related problems. So, it is actually a two step process all together. So, if you start with ability of data and the kind of problem. So, by a by using all these data first you prepare a models. That means, the moment is or the step is like that the full of the bus basket of data only give you some kind of model structure and that model need to be optimized a properly as per your requirement.

So, now which particular tools you have to apply to get a particular decision model. So, that is actually varied a kind of a complex process. So, it is not so easy to just you have to transfer, because you have to go through lots of check cross checks and reliability check, validity check and then the requirements significance kind of requirements or kind of outputs.

Then the basis of that you have to again stimuli the process. And then finally, once the model is ready the; decision model is ready then ultimately you have to optimize and accordingly will we get the values of the decision variables. And then accordingly you have to take a management decision as per the requirement. And how you have to operate all these things, we will discuss in detail in the later stage.

With this we will stop here.

Thank you very much. Have a nice day.