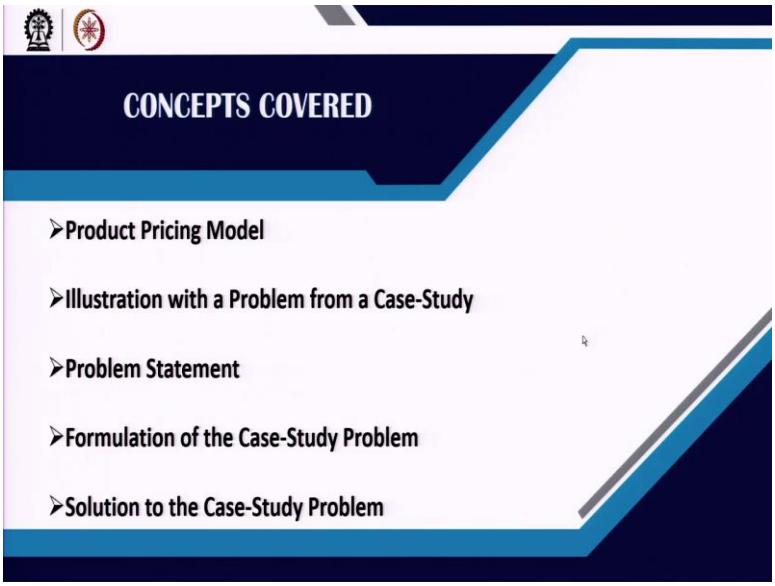
Decision Support System for Managers
Prof. Sujoy Bhattacharya
Vinod Gupta School of Management
Indian Institute of Technology, Kharagpur

Lecture – 39
Decision Support Systems for Marketing:
Decision Support System for Product Pricing Model

Hello and welcome to the "Decision Support Systems for Managers"! And this module is 'Decision Support System for Marketing' and we are covering DSS for a 'Product Pricing Model'. This is continuing with the third lecture in the same module.

(Refer Slide Time: 00:34)



So, the concepts we are covering are the product pricing model; we are illustrating this problem with a case study; we are listing out a problem from the problem statement; we are formulating that case study problem and then, we are giving the solution to the case study problem.

(Refer Slide Time: 01:04)

So, this is the schema of the way we go ahead in this lecture. So, as far as the product pricing problem is concerned, so this is one of the most important decisions in marketing and it has critical consequences than any other decision in marketing we may say that. So, product pricing is actually at the root of the marketing decision making.

So, setting and adapting prices in a competitive marketplace is a classical semi structured situation and we will see that how once we formulate the case study and it will involve both quantitative modelling and some intuitive skills.

(Refer Slide Time: 01:57)

So, pricing has been established long way back as a very important determinant which targets the maximization of a firm's profit. It comes under effect while handling the daily operations of industries towards demand manipulation and regulation of production and distribution of goods and services, whether it be in the domain of revenue management or in the area of supply chain management.

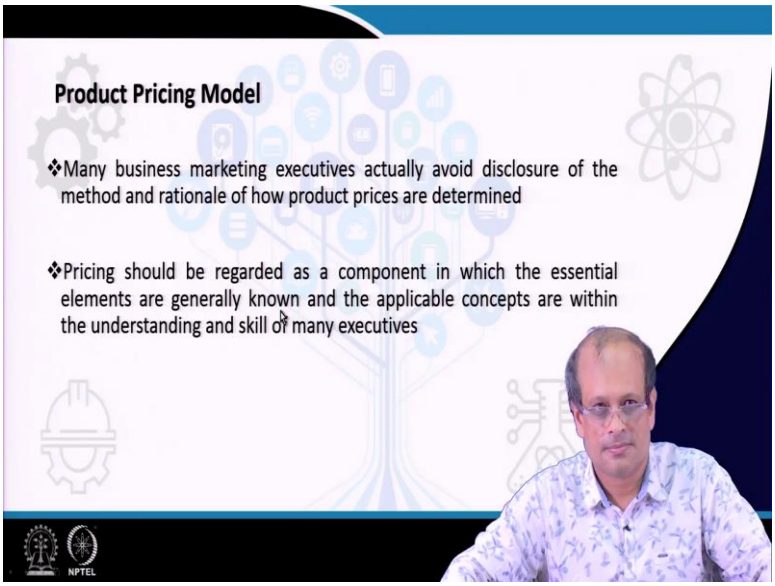
So, pricing is critical, this is the point we are trying to highlight. We are trying to say that pricing if correctly done, we will be able to maximize the firms profit and that pricing is ubiquitous. It is something which is going to be very important, when we regulate the production and distribution of goods and services and whether that be in the domain of revenue management or whether we are dealing with supply chain management.

(Refer Slide Time: 03:04)

So, in business marketing at a very basic level and yet it is a very critical decision, what should be the price to charge customers for the products and services. So, even in a B2B context, pricing is a very important decision.

So, in spite of all this, so the determination of price is one of the most inconspicuous secretive sacrosanct and sometimes, the least rational of the marketing strategy components, many of that decisions are based on intuitive gut feel of the decision maker. So, this case study will illustrate how to really work it out through a quantitative NLP approach.

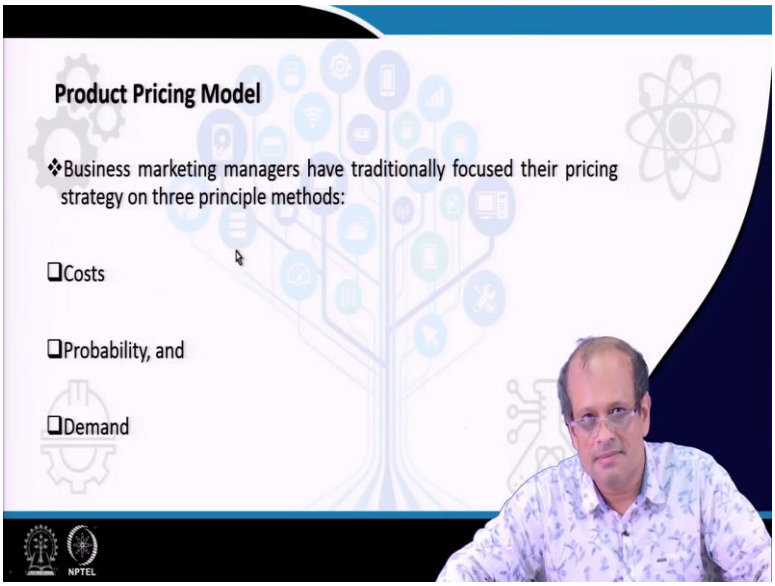
(Refer Slide Time: 03:54)



Many business executives actually avoid the disclosure of the method and rationale of how product prices are determined. This is continuing with the same thing, where we said this is what generally may not be disclosed by a firm. So, pricing should be regarded as a component in which the essential elements are generally known and the applicable concepts are within the understanding and skill of many executives.

So, this case study would illustrate that the basic essential elements would be known, and the method we will be using is something which can easily be handled by a decision maker.

(Refer Slide Time: 04:46)

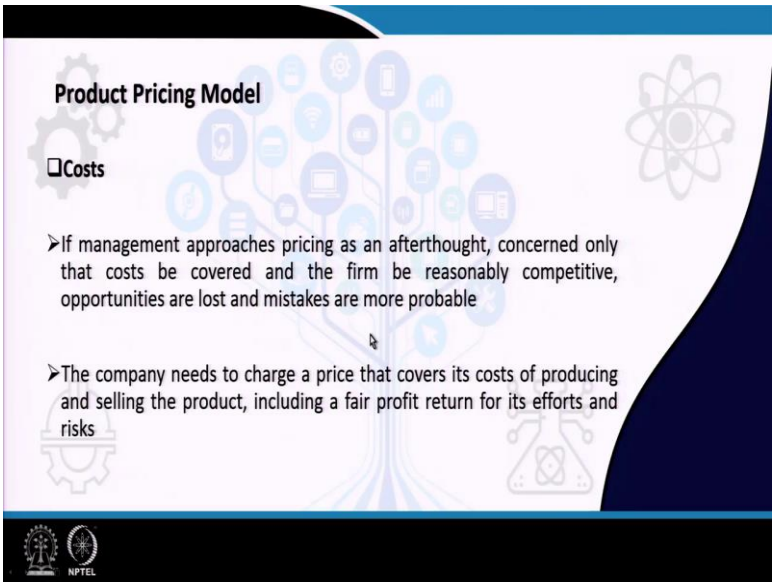


So, business marketing managers generally have focused their pricing strategy on three principal methods; first is the costs, second is probability and third is demand. So, 3 main methods have been used; cost driven, probability and demand.

(Refer Slide Time: 05:14)

So, costs represent a minimum level for setting price. This is in order to break even and so, it represents a beginning point in pricing. The costs set the floor below which the company cannot continue to market its product offering. So, costs are used to create a floor price below which the company cannot offer its products and services.

(Refer Slide Time: 05:46)



So, if the management approaches pricing as an afterthought concerned only that costs be covered and firms be reasonably competitive, opportunities would be lost and mistakes would be more probable. The company then needs to charge a price that covers its cost of producing and selling the product including a fair profit return for its efforts and risks.

So, the company then actually has to charge a price that should not only cover the cost of the production and selling the product, but should also give a fair profit return for the efforts and the risks which the company is bearing.

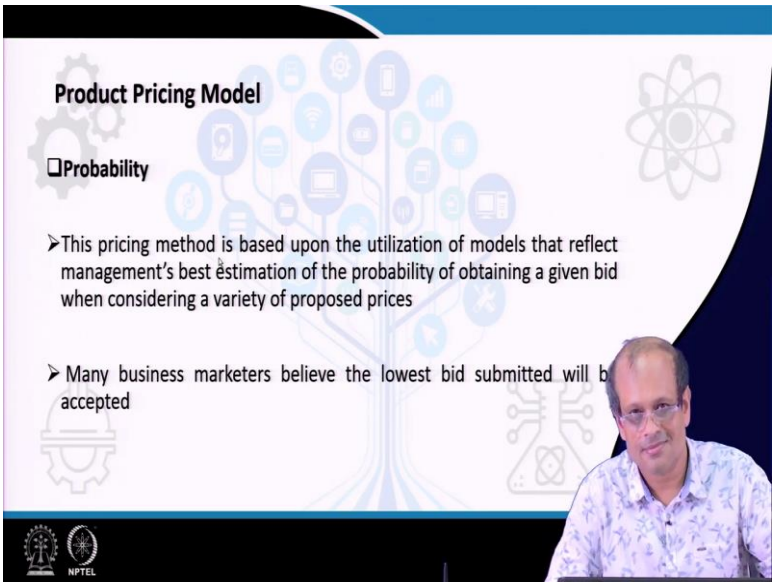
(Refer Slide Time: 06:36)

So, the successful differentiation allows the managers to charge somewhat higher prices than the competitors and it reflects the higher value of the product offering delivered to the customer. So, higher product differentiation would lead to a higher price being charged from the customers.

So, pricing strategies are generally cost based and little influenced by the marketers understanding of customers and competition. This may or may not be true, but sometimes it is true. So, if the pricing strategies are cost based, then it really does not understand the customers properly and also the competition is also not thoroughly understood.

So, we are then not able to reap the benefits of differentiation when the only limit ourselves to a cost-based pricing and then, we also are unable to handle the opportunities which the competition gives. The second element was probability.

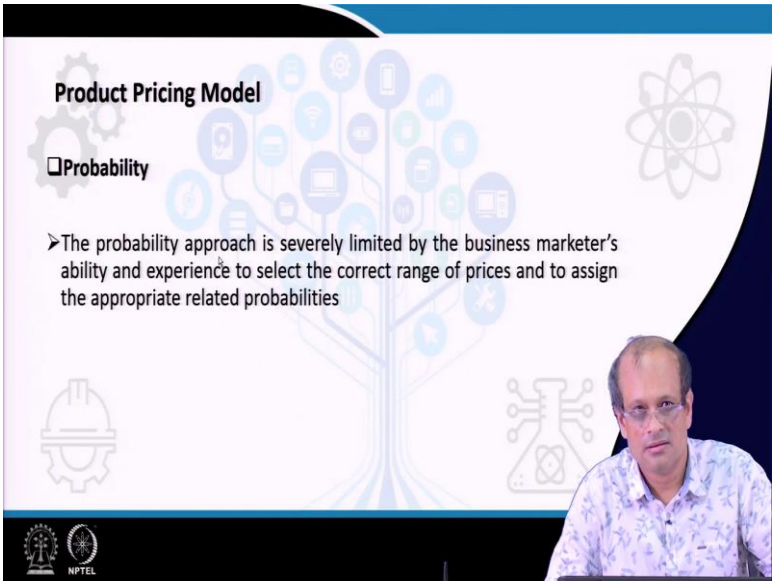
(Refer Slide Time: 07:43)



So, this pricing method is based on the utilization of models that reflect management's best estimation of the probability of obtaining a given bid when considering a variety of proposed prices. So, this then, translates to probability. Then, many business marketers believe that the lowest bid submitted would be accepted.

So, in this case what we are doing? So, we are estimating best estimation of the probability of obtaining a given bid is the basis for moving towards a pricing decision. So, this is a second approach.

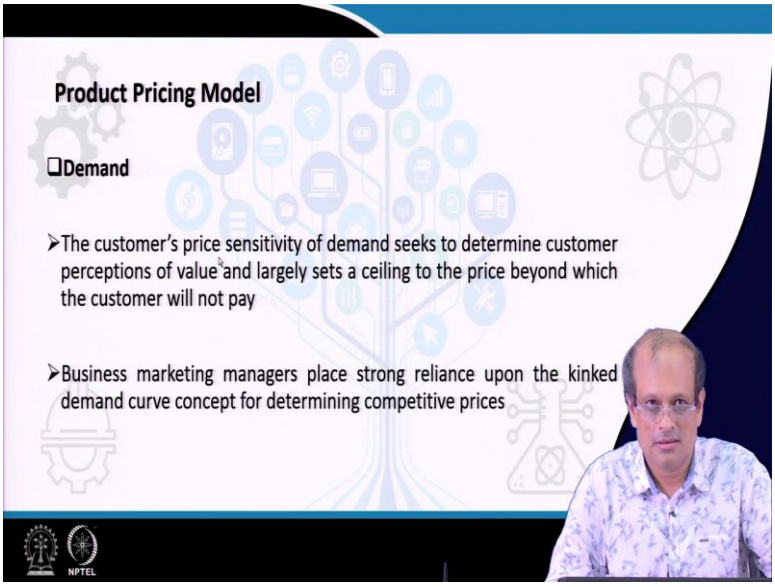
(Refer Slide Time: 08:32)



This probability approach is severely limited by the business marketer's ability and experience to select the correct range of prices and assign the appropriate related probabilities.

So, there is a strong limitation in this approach and the business marketer in that case is may not have the ability and the experience to select the correct range of prices. So, if there is a range in which the prices they believe should lie and their associated probabilities, both may not be correctly assigned.

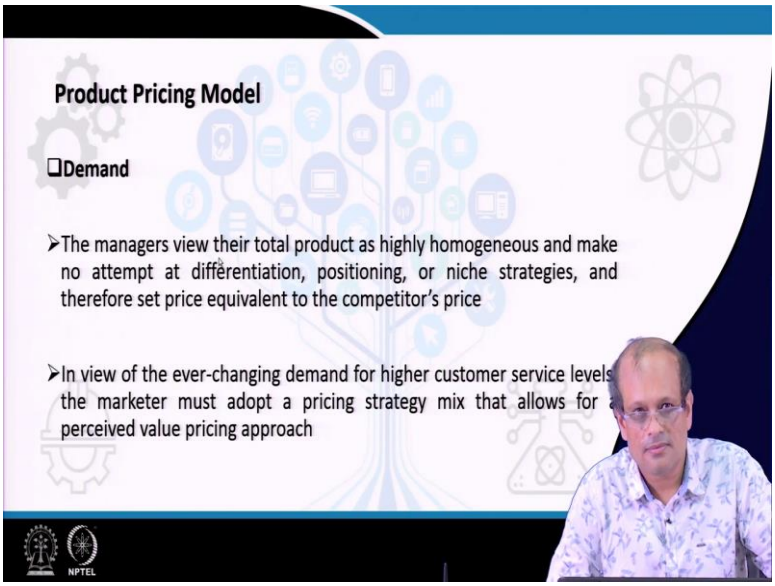
(Refer Slide Time: 09:12)



Then, we move to the next approach that is a demand-based approach. So, the customers price sensitivity of demand seeks to determine customer perceptions of value and that largely sets the ceiling of the price beyond which the customers will not pay. So, these are demand-based approach.

Business marketing managers place strong reliance, reliance dependence upon the kinked demand curve concept for determining competitive prices. So, this is used in the field and the field work is using the demand based pricing model and our case study also would use this approach.

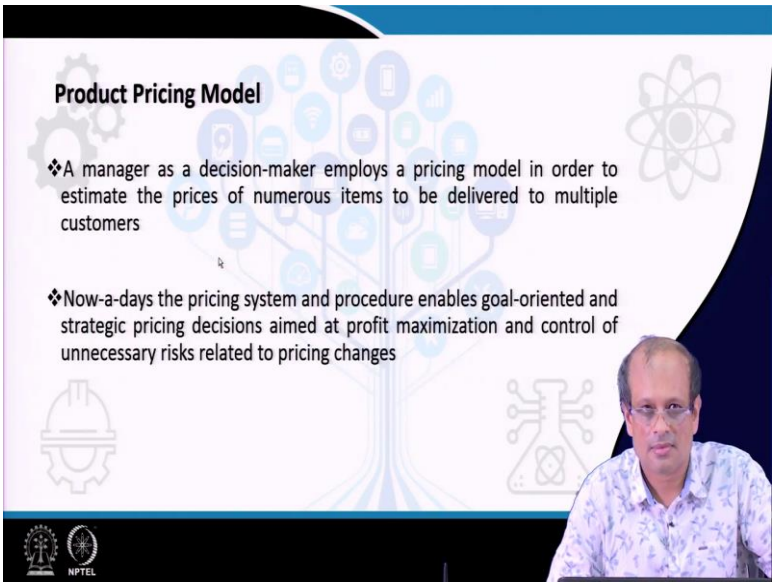
(Refer Slide Time: 10:05)



So, the managers view the total product as being highly homogeneous and they make no attempts at differentiation positioning or niche strategies and they therefore, set price equivalent to the competitor's prices.

So, but the truth is that the there is an ever-changing demand for higher customer service levels and hence, the marketer has to adopt the pricing strategy mix that allows for a perceived value pricing approach. So, the truth is then, there has to be a perceived value of the product or the service that should be the basis of the pricing approach which is generally recommended.

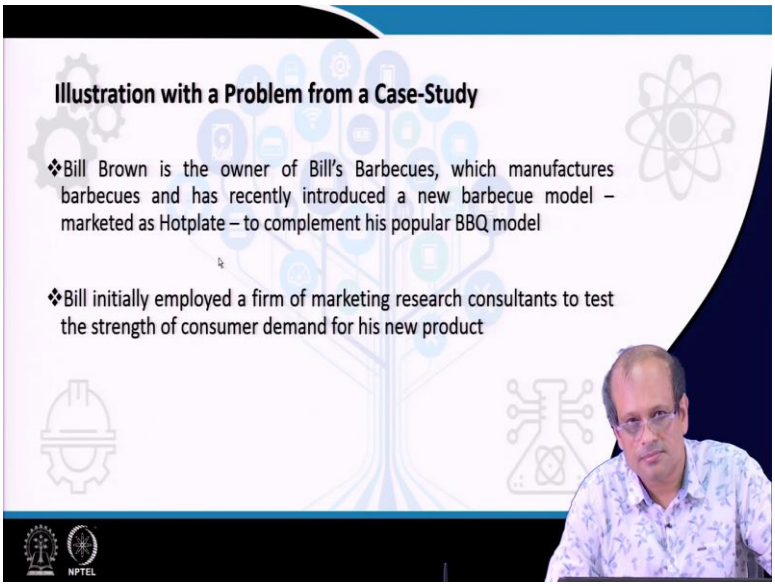
(Refer Slide Time: 11:03)



So, a manager as a decision maker employs a pricing model in order to estimate the prices of numerous items to be delivered to multiple customers. So, we have pricing not for one product, for multiple products and across multiple segments.

So, currently the pricing system and the procedure that enables the goal oriented and strategic pricing decisions which lead to profit maximization and also, controls all the unnecessary risks which are related to pricing changes. So, these models are generally operationalized. With this, primary focus and attempt is made towards operationalization of models.

(Refer Slide Time: 11:50)

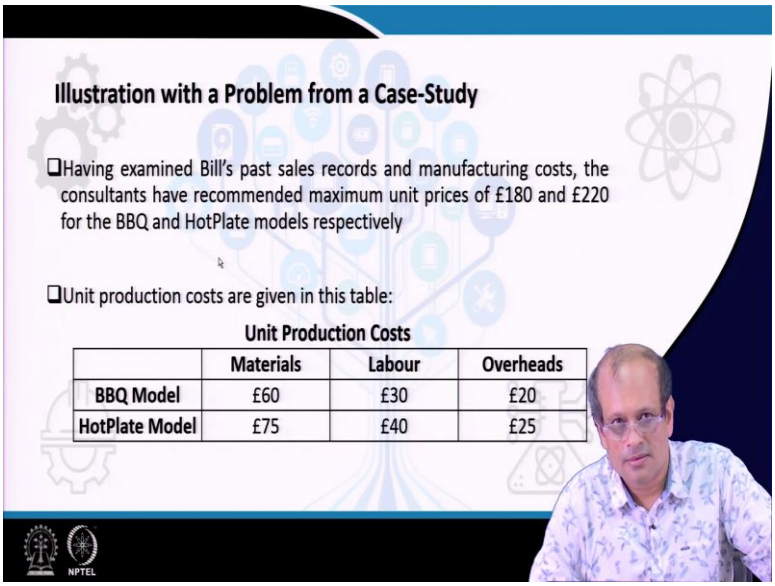


So, what we do is we will illustrate this pricing with a simple case study. The background of this case study is we have a person called Bill Brown and Bill Brown is the owner of Bill's Barbecues which is manufacturing barbecues and has introduced a new barbecue model.

And it is marketed as a hot plate to complement the existing popular BBQ model. So, this is the background and Bill then, employed a firm of market research consultants to find out the strength of customer demand for this new product which he is planning to launch.

So, what we are saying is there is a person who has barbecues which he manufactures and he wants to bring in a new barbecue model and he already has a popular barbecue model and he wants to complement that. So, first of all, he has asked a market research firm to talk about, to find out the consumer demand for his new product, let us see what happens next.

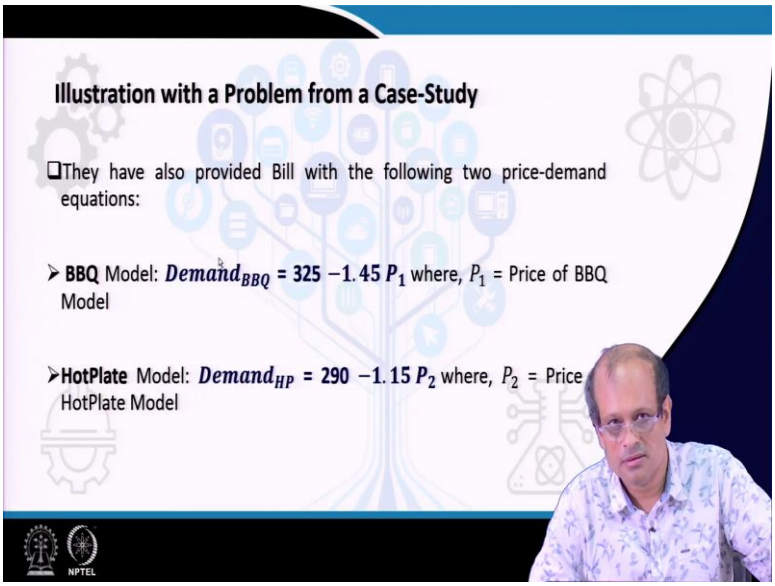
(Refer Slide Time: 13:19)



So, the market research firm has examined Bill's past sales records and the manufacturing costs and these consultants, this MR firm has recommended maximum unit prices a pound 180 and pound 220 for the BBQ and the hot plate models, that is their recommendation.

So, the unit production costs are given. So, for the BBQ model, the production costs are broken into materials, labour and overheads and we can see. This is the break up. For the hotplate model also the unit production costs are broken up into materials, labour and overheads. So, this is the data we have been given.

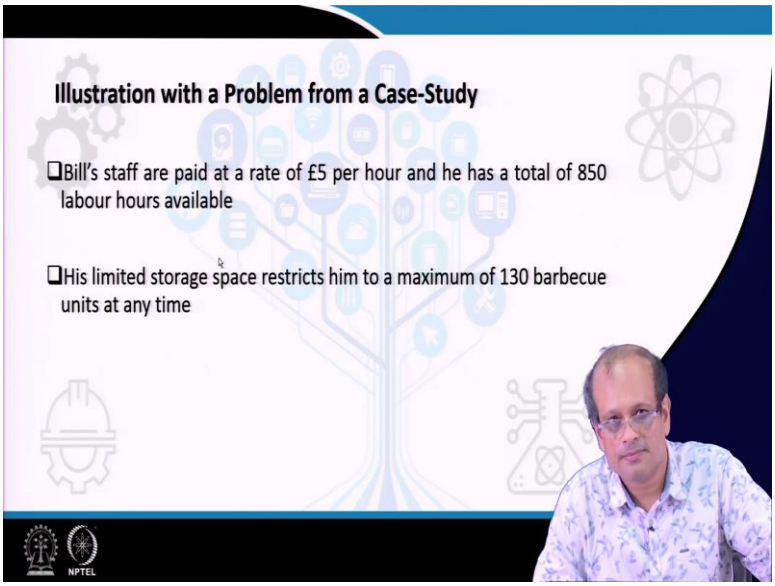
(Refer Slide Time: 14:14)



Now, they have also worked out the price demand equations; one for the BBQ model and one for the hot plate model, which is the new model which the owner wants to launch. So, let us look at it. So, the for the BBQ model, the demand sub BBQ; so, this is the demand function is 325 minus 1.45 P 1, where P 1 is the price of the BBQ model.

So, demand price equation has been worked out by the market research firm which was hired. Similarly, for the hotplate model, the demand for H sub HP that is demand for the hot plate model is 290 minus 1.15 P 2, where P 2 is the price of the hot plate model. So, we have been given two price demand equations which has been given to us by some MR agency which was hired by the owner of the firm; ok.

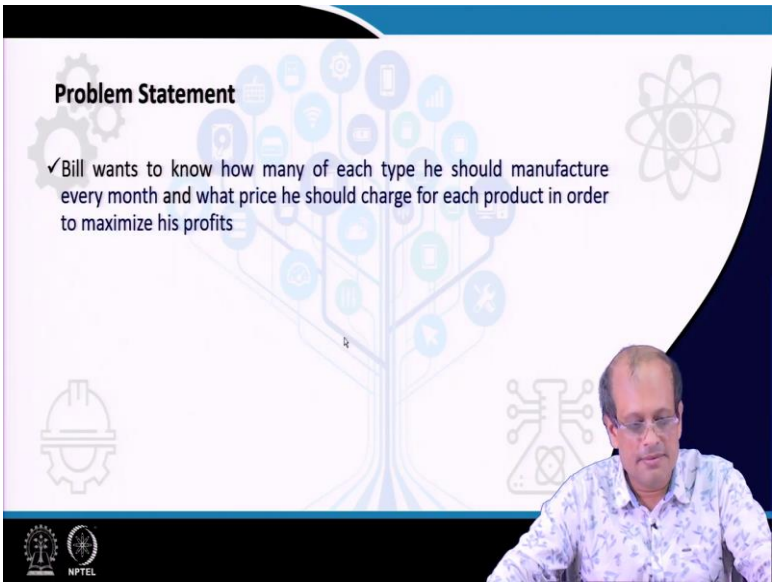
(Refer Slide Time: 15:24)



Let us move on. So, now, we have some more costs which we are bringing into the case. So, bill staff are paid at a rate of a pound 5 per hour and he has a total of 850 labour hours available. So, the constraint on the labour hours are 850, he has also limited storage space and this restricts him to a maximum amount of 130 barbecue units at any time.

So, there is a storage space constraint also which is 130 barbecue units. So, we have a constraint on the storage space, we have a constraint on the labour hours available, we have been given the rate of 5 per hour which is the rate at which the staff of this firm would be paid.

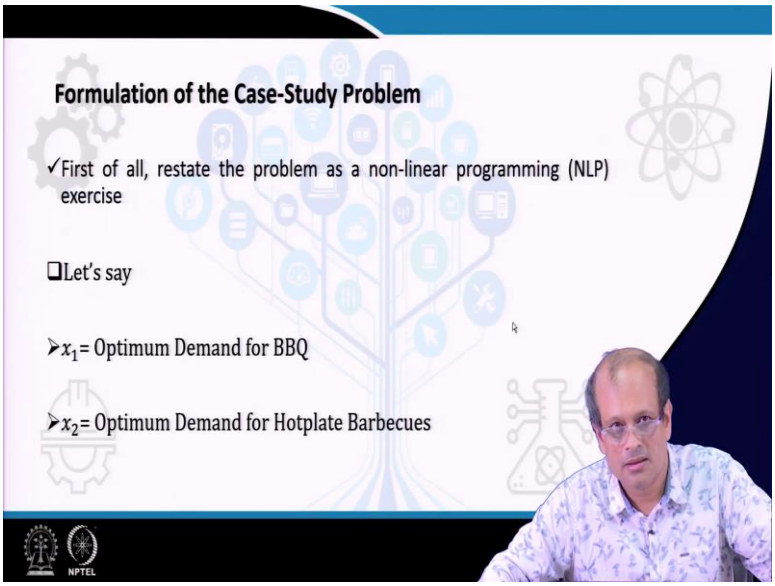
(Refer Slide Time: 16:28)



Let us move on. So, the problem statement is that the owner bill, he wants to know how many of each type; there are two types given of the products, should he should manufacture every month and what price, he should charge for each product in order to maximize his profits?

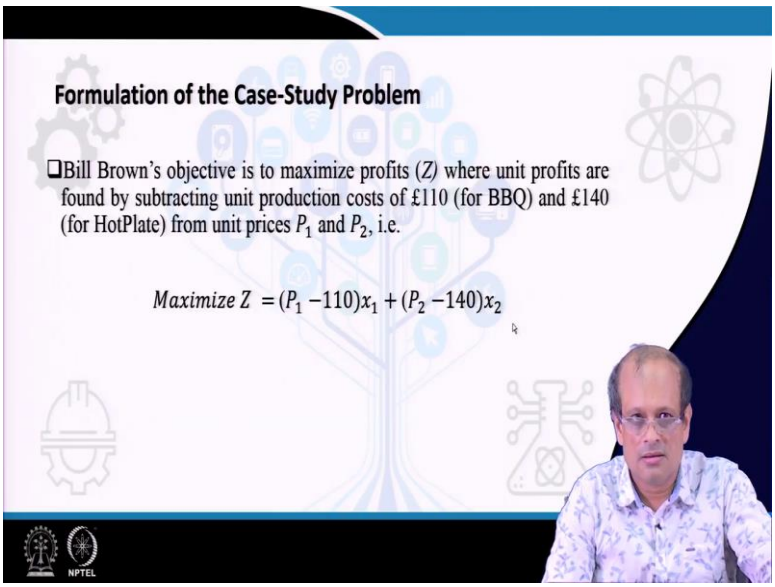
So, what does he want to know, how much of each type you should manufacture every month and the price, he should charge for each product? So, units for the two, how many units for the two types of products and the prices for the two types of products? These are things which the owner is interested in finding out given the data.

(Refer Slide Time: 17:17)



So, we start with the formulation of the case study problem. So, so we restate this problem as a non-linear programming problem. So, let us define the variables. Let x 1 be the optimum demand for the product one that is BBQ and let x 2 be the optimum demand for the hotplate barbecues for HP. So, x 1 and x 2 is the optimum demand which we have defined. So, variable definition is given.

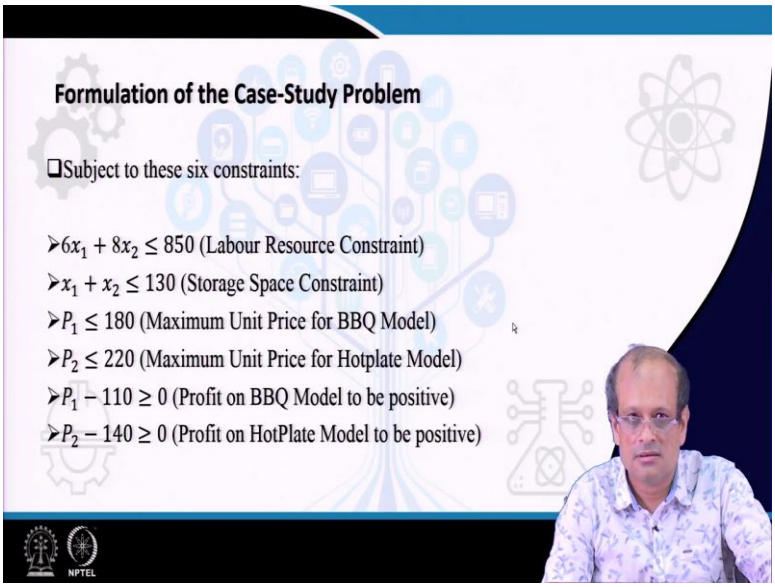
(Refer Slide Time: 17:54)



Then, let us come to the objective function. So, the owner Bill Brown's objective is to maximize profits, where unit profits are found by subtracting unit production costs of

pound 110 for BBQ and pound 140 for hotplate from unit prices P 1 and P 2. So, we are maximizing Z which is the profit equal to P 1 minus 110 x 1 plus P 2 minus 140 multiplied by x 2.

(Refer Slide Time: 18:38)

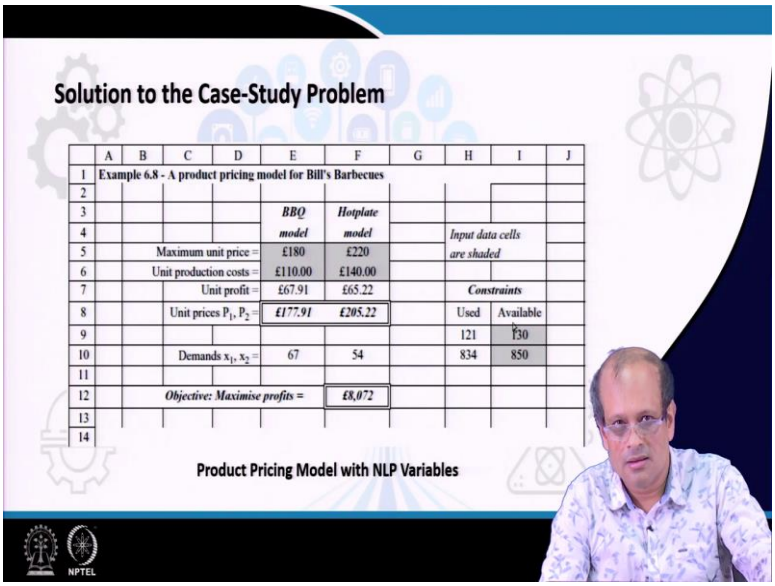


So, this is my objective function, which is now formulated. Now, let us move to the constraints. So, we have then 6 constraints and these are also which have completely come from the data given. So, the first was a labour resource constraint 6 x1 plus 8 x2 less than 850;

The second one is a storage space constraint that is x 1 plus x 2 is less than or equal to 130; then, P 1 is less than 180 that is the maximum unit price for the BBQ model; then, P 2 is less than 220 that is the maximum unit price, price for the hotplate model.

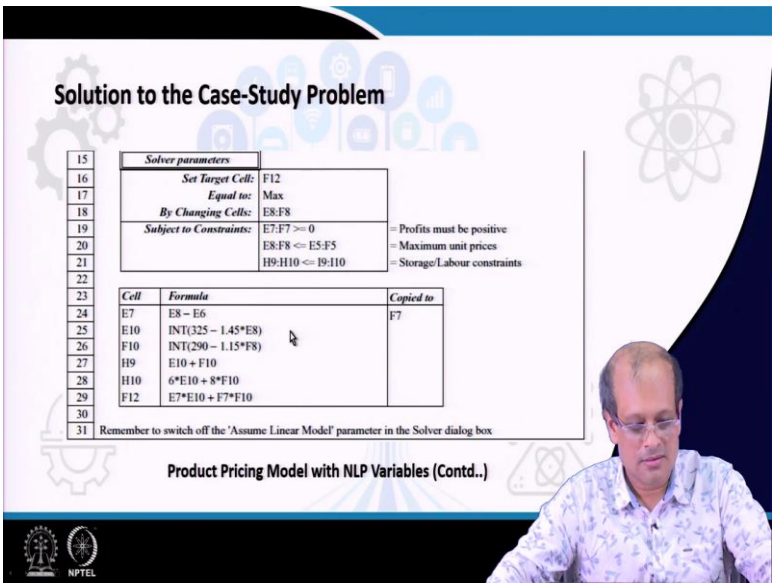
Then, P 1 minus 110 has to be greater than equal to 0, the profit on the BBQ model has to be positive, there has to be some profit, we cannot go at a loss; certainly, P 2 minus 140 has to be greater than 0, similarly for the hot plate model also the profit has to be positive. So, these are the constraints as obtained from the data given in the case and derived from the statement of the problem. So, now, that we have seen this let us move on.

(Refer Slide Time: 19:50)



So, what do we do? We use excel solver in this case and let us have a look at it. So, the input data as was in the previous class are given in the shaded section. So, these are the input data which we have given, the maximum unit price 180, 220 and the unit production costs 110 and 140 and we are looking at the constraints, constraints are 130 and 850 right. So, this is the input to the excel solver.

(Refer Slide Time: 20:31)

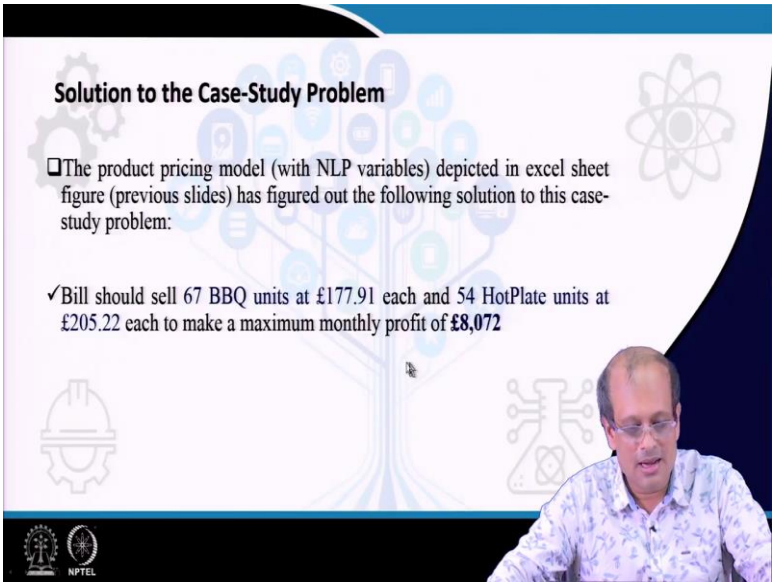


And then, we are setting the solver parameters. The target cell is F 12, we can we can look at this. So, we can look at F 12, this is the target F 12 and equal to the maximization

and the changing cells are E 8 to F 8 And the constraints are E 7 to F 7 0, E 8 to F 8 E 5 to F 5 that is profits must be positive.

So, this is just a translation of the constraints in the solver. So, first one is the profits must be positive; the second one is the maximum unit prices and the third one is the storage and the labour constraints. Then, the cell formulas are given here and these are also coming from the statement of the problem. So, we can see that E 7 E 8 minus E 6, they are copied to F 7 and similarly, for the others fine.

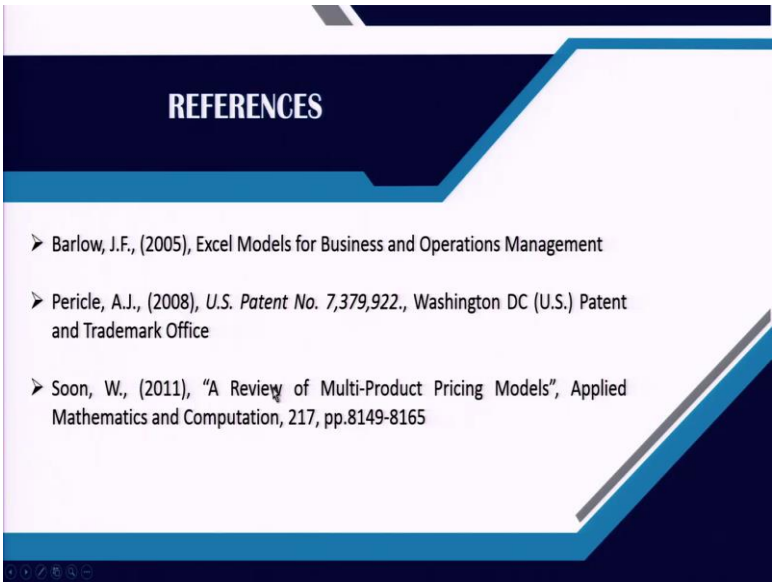
(Refer Slide Time: 21:44)



And thereby, we would be able to get the product pricing model with the NLP variables and let us let us talk about it a bit. So, the result we get at is that the owner should sell the 67 BBQ units and 177.91 units of the second at 167 BBQ units and 54 hotplates units at 177.91 and 205.22. So, we have got the units and we have got the prices and thereby, we will make a maximum monthly profit of 8072. So, let us have a look at it.

Wait, and we can see this 8072 is the maximize profits fine and unit price is 177.91 and 205.22 and unit profits are also given here and 67 and 54 are the demands for x 1 and x 2 using the solver and setting the parameters and putting in the constraints fine ok. So, we have been able to solve the problem as was stated in the case.

(Refer Slide Time: 23:07)



Let us move on. So, I will talk about the references now which were used. I have taken this case from Barlow, J.F. 2005, Excel Model for Business and Operations Management and certain things have been taken from a review of multi product pricing models applied mathematics and computation.

So, I will go back a bit. So, I will just review this part, wherein I will translate the statement of the problem and to its mathematical formulation once. So, I will again go back to what the MR firm supplied. The MR firm supplied that the demand was given as in our price demand equation for the first product BBQ and as a price demand equation for the second product, demand of HP.

So, this is what the MR firm did tell us and there were certain constraints which we had, an 850 labour hours and a maximum of 130 barbecue units could be stored that were our storage space constraint and we had to pay at a rate of 5 units per hour to the staff. So, this is the problem which we had fine.

So, using that we wanted to answer two questions; how much and at what price should these two product items be manufactured. So, let us again live review this. So, we said that x 1 and x 2 are the two-optimum demand for BBQ and the type two product which is the existing, which is the new hot plate barbecues; so, using the MR information which we had coming from the data which is given to us, we were able to create an objective function P 1 minus 110 x 1 plus P 2 minus 140 x 2.

So, using this, then we finally, use the constraints. 850 was a resource constraints. So, 6 of x 1 into plus 8 into x 2 was a labour resource constraint, then the storage space constraint, then the maximum unit price, then the maximum unit price for the hot plate. So, these are the two maximum unit prices for the BBQ and the hot plate model and then, there are two positive profits on the type 1 product and the type 2 product, this is what we saw.

So, we were able to have the constraints. So, the real thing which as a manager, we should be able to do is we should be able to translate a statement of a problem given to us in a language form to a mathematical formulation. There are many softwares which will be able to solve such problems. So, but the formulation is where a manager should be good at; ok.

So, moving on, so this is how we entered the data in the sheet in excel. So, the grey area as I said where the places where we entered the data and so, all the unit prices at a maximum value and our unit production costs and the constraints which are there with us in terms of 130 and 850 which were coming from 130 storage space constraint and 850, the labour resource constraint.

They are coming and we set the objective function and here we will get the value of the maximization. So, the solver parameters we discussed. So, first profits must be positive then the maximization of the unit prices, then the maximum unit prices and then, the storage and the labour constraints. So, all these are coming in the cells fine right.

So, the both the questions how much to manufacture are answered, it is 67 BBQ and 54 hotplate units and at what prices to manufacture, 177.91 and 205.22 and also, we are able to find out the amount of maximum monthly profit which we got.

So, this is an example which we had and this example is a demand driven case, wherein we had a product pricing model and we use an NLP method to solve the simple case and arrive at a solution in terms of both pricing and the number of units which will maximize my firm's profits.

So, this is the third lecture in the series of the 'decision support system for marketing', the module; ok. Now, we will continue in the fourth lecture with one more case on 'decision support systems for marketing' and again, look at the references.

So, I have used two references I said; one was Barlow, Excel Models for Business and Operations Management, and I have also taken material from Soon, W., 2011, “Review of Multi-Product Pricing Models”, Applied Mathematics and Computing; and something from here; fine.

Thank you very much! See you in the next lecture! Thank you!