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

Module – 04
Lecture - 16
Decision Making for Warehouse Location: Factor Rating & Break - Even Method

Hello and welcome to "Decision Support Systems for Managers"! We are into module 4, 'decision support system for materials managers' and today is lecture 1 of module 4, decision making for warehouse location; factor rating and break even method; ok.

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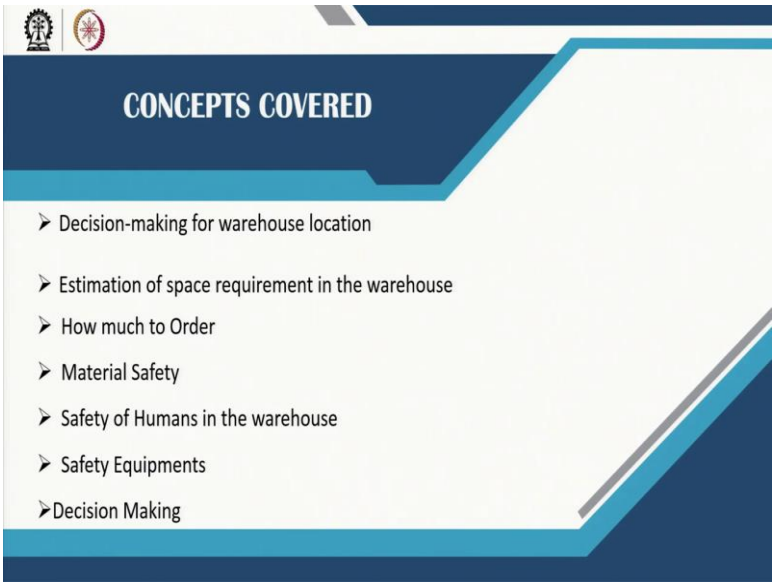

Now, you see the things that we will cover in this decision support system for materials managers first let me tell you this and then or let me give you the introduction for this first, then we will it will be easier for you to understand why we are doing this etcetera.

See; warehouse managers is a very-very complicated thing today; why? You will see in your organizations that every organization is trying to either shut down a warehouse or reduce the warehouse space. Because at the end of the day, warehouse is a cost centre. Warehouse as such does not generate income, does not generate revenue, the product generates revenue where.

So, all the other functionalities associated with reaching the product to the consumer is a cost centre. The entire supply chain which is the thing that is we are in discussed is a cost centre.

So, warehouse is a cost centre you have to pay money for the rent of the warehouse which is not a small amount, it sometimes goes up to 8-9 lakhs of rupees per month for a single warehouse.

So, it is rent of the warehouse, electricity bill of the warehouse again runs into 1 lakh plus for some giant warehouses per month so, rent of the warehouse, electricity bill of the warehouse, the staff salary, water facilities, maintenance and upkeep, security so, warehouse is a cost centre. More bigger is the warehouse, more is the cost. So, every company is putting tremendous emphasis on developing systems wherein you will discard or do away with all your warehouses.

I will tell you a simple story, a simple thing that you can notice or just try around. If you ever travelled by the river or have been to cities which are beside the river. River means not smaller one's big rivers like the Ganga. All the old cities Calcutta, Varanasi and many other places you will see some very very old buildings which are warehouses which use to be warehouses, now they are put to other use.

What is the reason? That earlier the river routes were very very prominent. So, the goods will come in via river route either on boats or on vessels and they will be put in warehouses just beside the rivers and then according to demand, as per demand, they will be dispatched ok.

But what is the change system now? Goods are directly leaving the factory premises, the production facilities and via the road route, they are directly going to other factories where they will be used or they are going to wholesaler or distributor premises in their smaller godowns, smaller warehouses.

So, the large warehouses that were beside the rivers they are no more required. This is what I want to say that where every organizations effort is there to remove the warehousing system because that has a huge cost ok.

So, all mathematical models are being developed, tried, some structured, some unstructured, some semi structured how to do away with warehouses and what is seen is that which you will do just immediately after this module that is forecasting plays an very important role in doing away with warehouses.

If I can forecast my demand correctly, if I can synchronize the demand time when the product is getting demanded and the production time when it is getting produced, if I can synchronize it and if I can forecast accurately, then there is no need for warehouses at all. So, lot of effort are going on and to some extent this has enhanced forecasting accuracy to a great deal and we are slowly trying to reduce the warehouse sizes also because if I do not store more, I do not need that much of space in the warehouse.

So, a warehouse manager is in a double edged sword. One hand he has to maintain the warehouse at least for the time being to supply products to the end customer wholesaler, retailer and the end customer and the other hand, he has to find ways to reduce cost and ultimately get rid of the warehouses at totally ok.

So, these so, now actually, if you see that is what we will try to this entire gamut, this entire concept we will try to cover in this module, in this particular portion of your syllabus ok. So, that is why the concepts covered decision making for warehouse location, estimation of space required in the warehouse, how much to order, material safety.

Now, this how much to order is very important. If you order more what will happen? You will require more space in the warehouse. If you order less, you require less space rather do not order lump sum order in piecemeal so, the products will come in small pieces consignments and will also go away in smalls. So, space required in the warehouse will be less. So, these types of decisions.

Safety of the materials, safety of humans in the warehouse, safety of workers, safety equipment's and what decision making you can do you need to do. So, if you see again let us see decision making for warehouse location, you estimate the space requirement in the warehouse lesser the space lesser is your cost how much to order?

Material safety, safety of material; safety means there are certain material, you have to keep in very-very, in a careful manner; lesser gas wasted. Safety of humans in the

warehouse, safety equipments, what equipments will you use in the warehouse? Certain warehouses is have chemicals, they store chemicals, any chemical may catch fire, may lead to an accident and what type of decision making you need to do right.

So, the first part we will do today in this lecture decision making for warehouse location. These are all part of this module which we have said decision support system for materials managers. If you look at it a earlier, material manager was a separate genre altogether, but nowadays, it is a warehouse manager, materials manager these the roles, the job roles are constantly changing.

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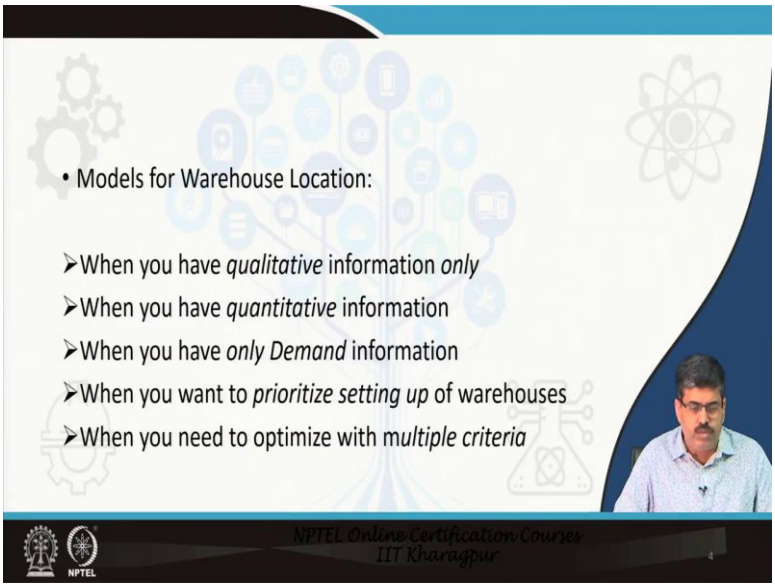

Now, the models for warehouse location are many. First is when you have qualitative information only. You do not have any numbers to prove yourself. You have only qualitative information. I am better than him, he is better than her. That is to say this place is better than that place, that place is better than the other place.

When you have quantitative information. When you have numbers to prove your point. When you have only demand information you do not have supply information. When you want to prioritize setting up of your warehouses means you will set up warehouses, but not you want to set up five warehouses, your mathematical model has told that I want to set up five warehouses, you have to set up, but you do not have money, you want to set up warehouse 1, then 2, then 3, then 4, then 5.

So, what is the; so, what is the priority in which you need to set it up? So, when you want to prioritize setting up warehouses that is point number 4 and when you need to optimize with multiple criteria ok. So, these are the models for warehouse location. We will do a few of them because some portions, we will link it up with other modules that are coming up in this course.

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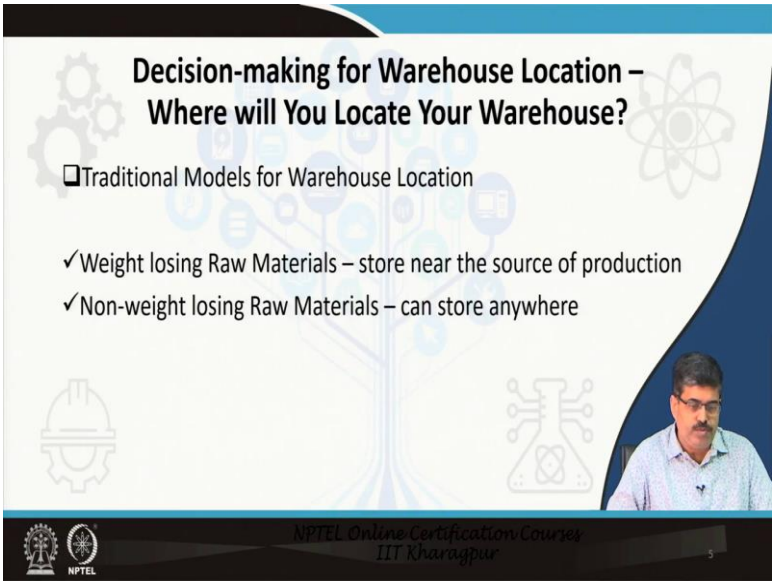

Decision making for warehouse location traditional models for warehouse location, one is weight losing raw see weight losing raw material and the other is non-weight losing raw material. What does it mention? It mentions that you know if it is a weight losing raw material, then store near the source of raw material ok.

For example, weight or volume actually. For example, cotton. Cotton is used to make the thread and then the fabric is woven from the thread right. So, but cotton is huge in volume right is huge in volume. So, if you have to transport that cotton all over the country, then it will become a great problem.

You will require huge number of vehicles rather make it a thread, then transport, go one step ahead, make it a roll of fabric and then transport your volume comes down. Weight remains some sort of same, but then maybe the volume comes down. Same applies to weight also. Some materials have a have more weight raw material. When it comes down to the finished product, it might have less weight.

So, the issue is when it is a weight losing raw material or voluminous raw material, store near the source of production. So, that you do not spend on transportation cost and when it is non-weight losing raw material, you can store anywhere ok. So, this is basically the earlier pattern of thinking and the person who propounded this theory was Max Weber.

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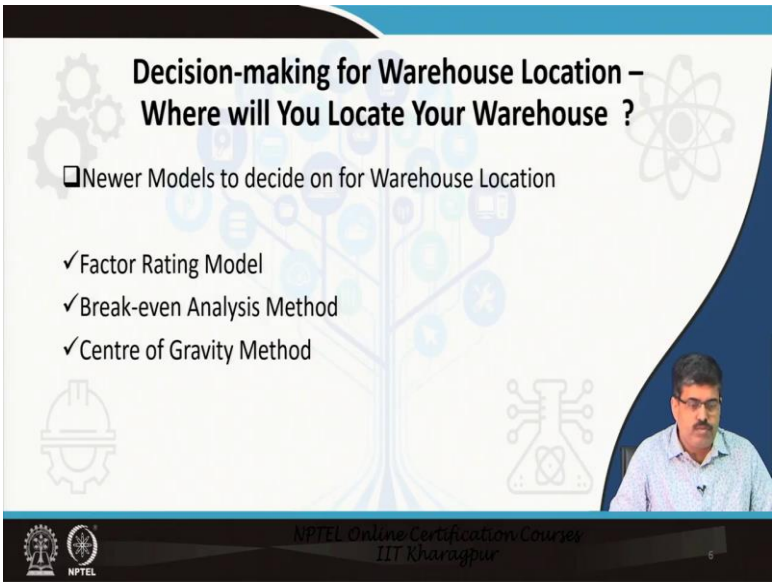

What are the newer models? The newer models are factor rating, break even, centre of gravity ok.

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Ardalan, transportation cost model, total cost model these are the newer models.

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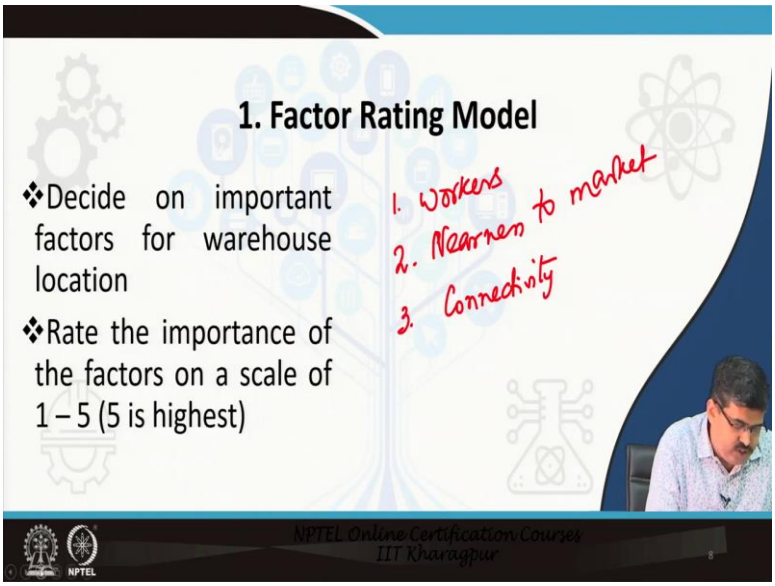

So, first today we will consider the factor rating model ok. Factor rating model basically is very simple. The simplest form of decision-making model. One is so, first you decide on important factors for warehouse location and rate the importance of these factors on a scale of 1 to 5, 5 being the highest.

Let us take; let us take an example. Decide on the important factors for warehouse location. What are the important factors? Let us take you are having a leather goods warehouse. What are the important factors? 1 is workers; 2nd – nearness to market. It has to be sold right.

You cannot have a shoe warehouse somewhere in some place where population is very less transportation cost will be very high. 3rd connectivity. Though it is nearness to rather we will do something, we will change the nearness to market.

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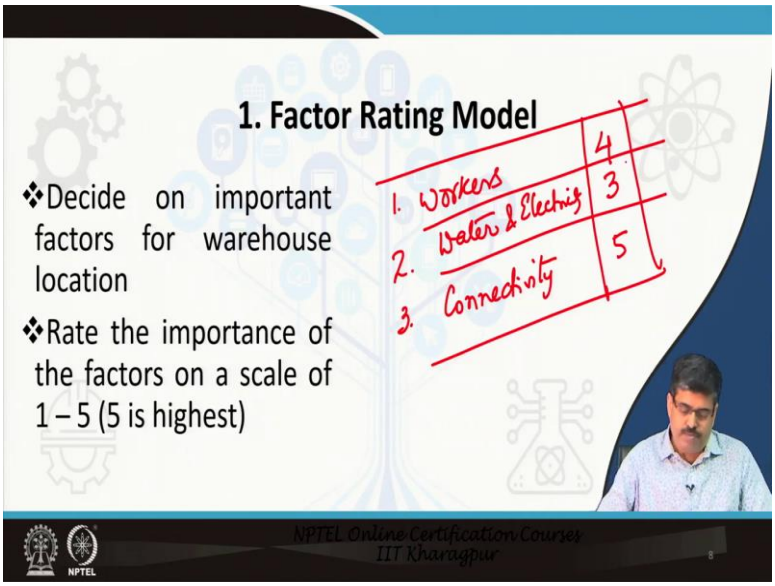

Let us make number 2 as availability of water and the 3rd is connectivity; ok.

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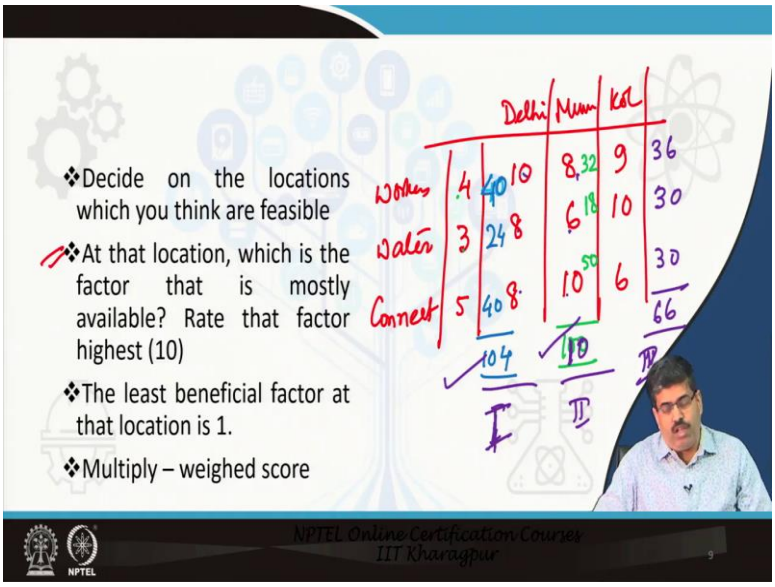

So, this is the first point decide on important factors for warehouse location. These are the factors that we find for my product, it is not in general right. It is for my product. Rate the importance of these factors. These are the factors, but which one is more important for your company.

If it is a FMCG product, more important is connectivity, next may be [FL] let us put water and electricity; ok; next is worker that is most important and 3rd is water and

electricity. So, this is the first step see we have drawn it. Decide on important factors for warehouse location, rate the importance of these factors. These are the; these are the factors worker, water, connectivity and the importance of these factors are 4, 3, 5.

Decide on the locations which you think are feasible. So, let us go back; we had workers; I am just writing in short; water, connectivity; and we said; connectivity was important, workers were important; right; did we?

Yes, water and electricity right. Now, it is saying decide on the look at the first point decide on the locations which you think are feasible. Let us put Delhi, we will take only three because of the space thing here. We have taken decide on the locations which you think are feasible Delhi, Mumbai, Kolkata.

Next point at that location which is the factor that is mostly available; at that location which is the factor that is mostly available? Rate that factor at highest 10. Workers: workers in Delhi available yes, Mumbai may be all are employed in some other areas let us keep that definitely workers are available, but we do not know whether they will work in our warehouses, Kolkata yes. Water Delhi, connectivity; ok.

See whether you are understanding point number bullet point number two with this one; right; clear. Multiply and get a weighted score. So, what does Delhi's score become? What does the Delhi's score become now? Let me put a different ink. Delhi is 10 into 4 that is 40, water 3 8; 3 into 8 24, 5 into 8 40. So, what is Delhi's total score? 104; ok.

What is Mumbai's total score? 4 into 8 32, 3 into 6 18, 5 into 10 50 100. Some weight actually; ok. What is my score for Kolkata? 4 into 9 36, 3 into 10 30, so, 66. So, which should be my most favourable location 104 and 100. So, this is my location 1 location 2; location 1 location 2 right and location 3. So, this is what is called as factor rating method.

Now, this is what semi structured situation is giving you. Why do I say semi structured? Because these numbers are given by our based on our understanding. It is bit structured and semi structured it is somewhat both of the worlds; ok.

Now, again why is semi structured? Because your top management has to now decide whether to set up in Delhi or whether to set up in Bombay. This; the scores are very close

by and if you give the same exercise to another person, that other person has a different perception; so, maybe Mumbai will get this time a score of 110. So, it is very close. So, that part is left to the manager; ok.

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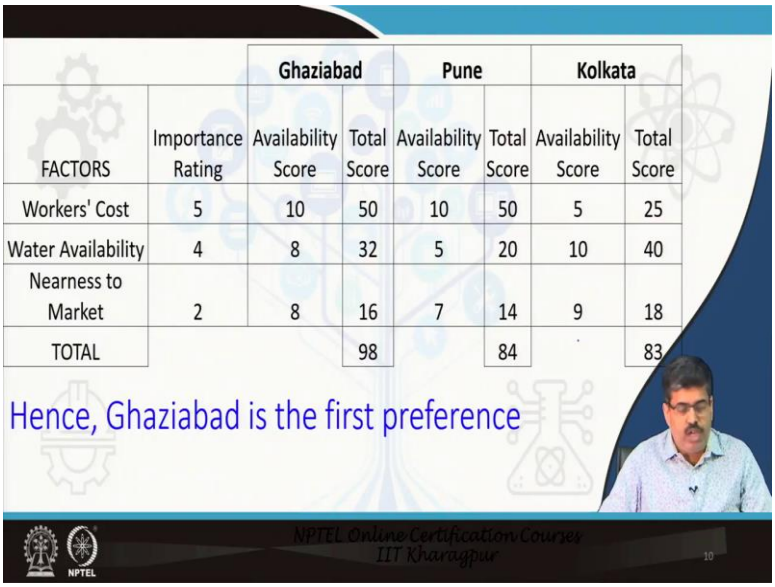

So, this is what basically we did when example with Ghaziabad, Pune and Kolkata and this is what the scores are; ok.

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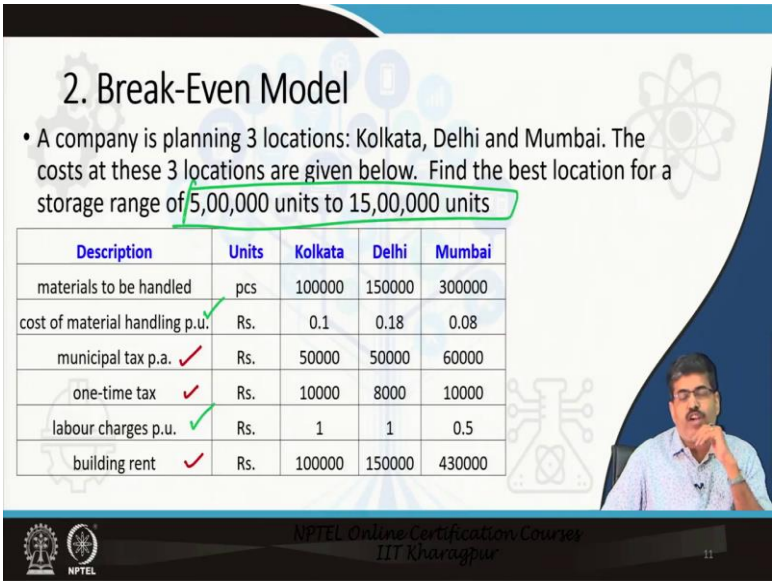

Let us go to the break-even model; ok. Break-even model is very easy to understand; ok. Break-even model let us try read it. A company is planning 3 warehouse locations:

Kolkata, Delhi and Mumbai. The cost at these 3 locations are given below. Find the best location for a storage range of 500000 units to 1500000 units ok. So, the company has decided that I will manufacture between 5 to 1500000s. Find the best location for storage for 500000s to 1500000 s; ok.

Now, let us see we have been given Kolkata, Delhi and Mumbai. Materials to be handled; materials to be handled at Kolkata 100000, 150000 and Mumbai 300000s. Cost of material handling per unit 1, 0.18, 0.08. Municipal tax fifth this. One-time tax this. Labour charges per unit this and building rent is this; ok.

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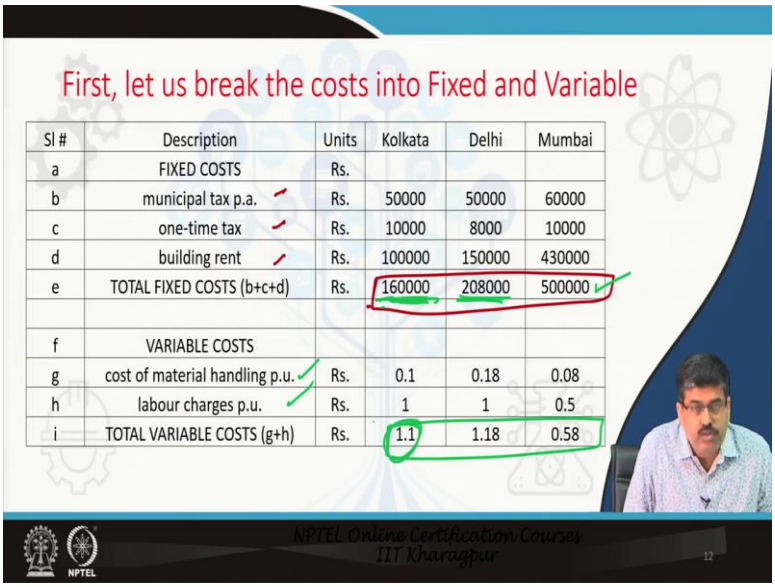

So, we have to find out the range of output between 500000s to 1500000s ok. How to solve this problem? What will you do? First, let us break the costs into fixed and variable cost because that is the basic tenet of a break-even analysis.

What are the fixed cost? If you go back, fixed costs are municipal tax, one-time tax and building rent. These do not change too much with the output right. So, fixed cost, municipal tax, one-time tax, building rent. So, we add it up these are my fixed cost for these places right.

What are the variable costs? The variable costs are cost of material handling, labour charges right ok. So, cost of material handling, labour charges. So, total variable cost if we add it, variable cost means per unit per unit this right. What are we supposed to? So,

agreed? What are we supposed to find out? The range between 500000 to 1500000 units; right.

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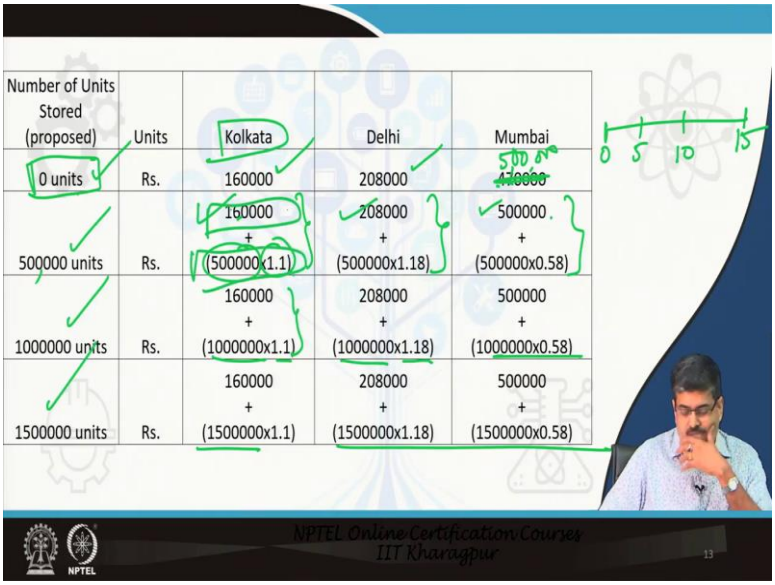

So, how to do this? Let us put 0, 500000s, 1000000s and 1500000s 0, 5, 10, 15. So, just like a graph if you see 0, 500000s, 1000000s and 1500000s something like that right. When it, when my production is 0 units, what is the cost at Kolkata? The fixed cost only no variable cost let us go back Kolkata fixed cost is this right sorry Kolkata fixed cost is this right. So, let us go when the production is 0 units; only the fixed cost.

Delhi, what was my fixed cost? 208 let us see 208, when production is 0 units that is only fixed cost when production is 0 right ok. Mumbai, what was the fixed cost? 500000s I do not know 400000 70 60 430 this should be 500000s I am so sorry 500000s I have put, but then Mumbai has somehow here it has become this thing 500000s.

When it is 500000 units of production, 16000 is my fixed cost this and this one, here it is 500000s there is no problem. 16000 is a fixed cost, 500000 units into 1.1 go back 1.1. So, when my production is 500000 units, my this cost is 500000s in 1600000 fixed cost plus 500000 into 1.1 variable cost this is the total cost if my production is 500000 units similarly, this is the total cost of my production is this and this is the total cost if my production is this; ok.

Similarly, when it is 1000000 units, this is my fixed cost, these are my 1000000 units into 1.1, 1.8 this thing. So, variable cost and when it is 1500000; this, this, this; agreed; right.

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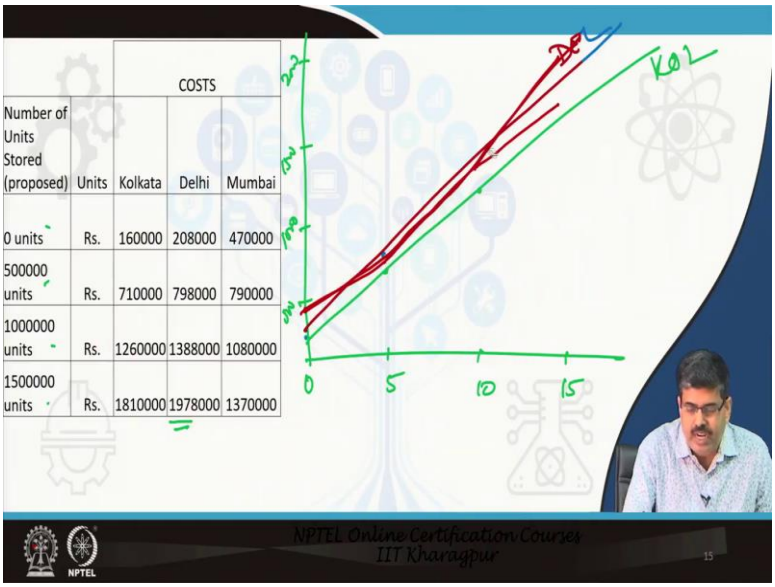

So, just add it and what do we get this, is the structure that we get. So, this is the addition remember 71000000 if you do, 500000s into 1.1 500000 50 plus 100000 60 710000; ok. 500000 50 plus 100000 60; 500000 50 plus 100000 60 is 710000; ok. So, this is the; this is the working table and this is the final table; ok.

Now, can we draw a graph out of it; ok. This is the sheet so, can we draw a graph? Definitely, we can draw a graph. 0, 500000 units, 1000000 units; sorry, let me make it a bit bigger; I am so sorry.

0, 5, 10, 15; ok; 0, 5, 10, 15. What is my highest cost? 1978; right. So, it is 2000; ok. 5 500, 1000, 1500, 2000; ok; 500, 1000, 1500, 2000; ok. Let us take Kolkata; ok. We will use this green color. Let us take Kolkata, 0 units Kolkata cost is 160. So, 7 8; right. So, 160 so, somewhere here; ok. When it is 500 units, it is 710; right. 1260, when it is 10000 units 1260 and then, for 15000 units; so, this is my Kolkata line; ok.

Let us take a blue line for Delhi. It is 20 a somewhere here actually 208, then 798, 1388 and then is 1978 so, Delhi is always higher than Kolkata ok. Mumbai will be this is just a drawing. So, when you draw it will be proper, this is just a hand drawing. If you do it in

excel, it will look better and you will get a exact pin point at this thing 470, let us take another with another color let us take 470,790 790 and 108 it is somewhere here and then, it is sorry 137 I will put a eraser here; then ok.

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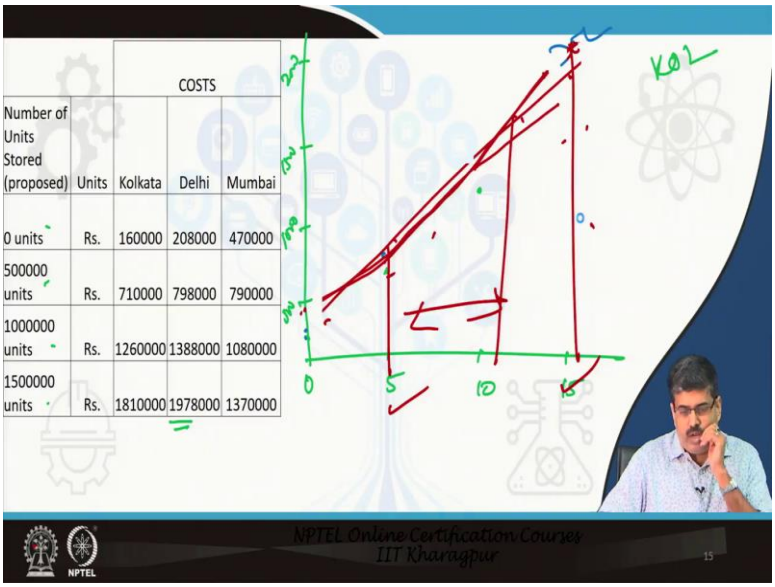

So, basically it cuts; I am sorry. So, basically it cuts; right; it cuts. So, we get a range of output for which the quantities we get a range of output between 5 to 15 and we get to know which warehouse is more suitable than the other; right.

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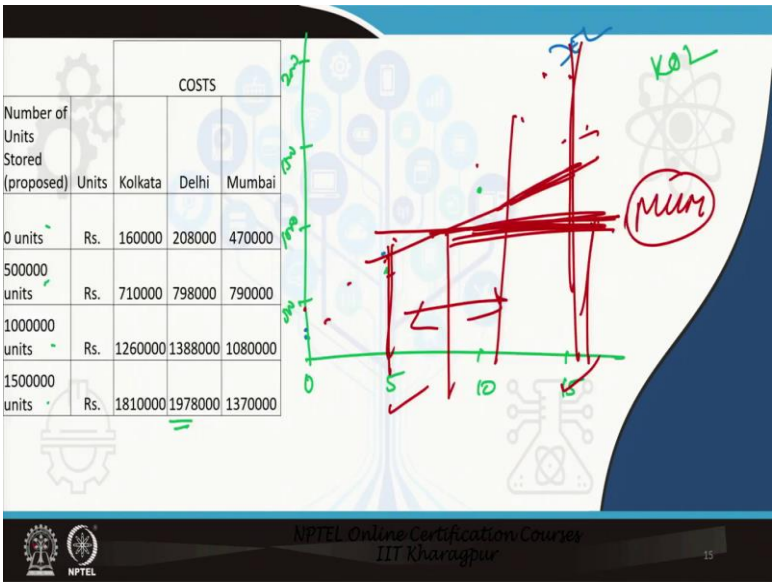

So, this is basically the breakeven point method of warehouse location. If you draw this graph properly in your exercise book, you will see that it cuts and wherever it cuts, say the diagram is like this so, this, for this range this cost is lowest right this cost is lesser than this particular cost. So, this cost is less. So, for this range, this particular warehouse assume it is Mumbai, for this range this particular warehouse is cheaper as simple as that ok. So, you do it.

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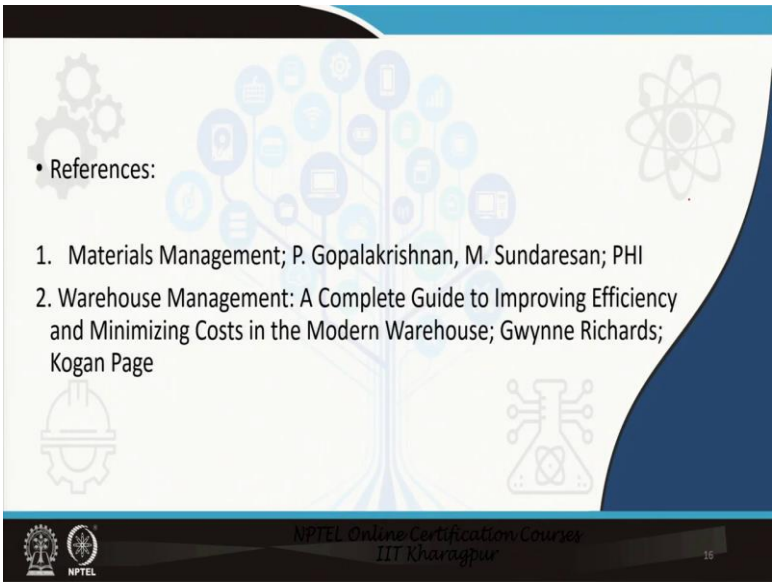

These are the reference materials. These are all very-very standard books which you can go through to get a brief about these discussions; ok.

So, thank you!