Modelling and analytics for supply chain management
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Lecture 43 - VIKOR and ISM Method

Hello and welcome to modelling and analytics for supply chain management.

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We are into week 9, lecture 43, that is the multi criteria decision making models in supply chain, and as part of this module you have already learnt AHP, you have learnt TOPSIS and in the previous lecture we have given that is the introduction to VIKOR methods. Today, we will complete the VIKOR method, we have only a little bit of portion left and then we will move on to the ISM method of multi criteria and decision-making.

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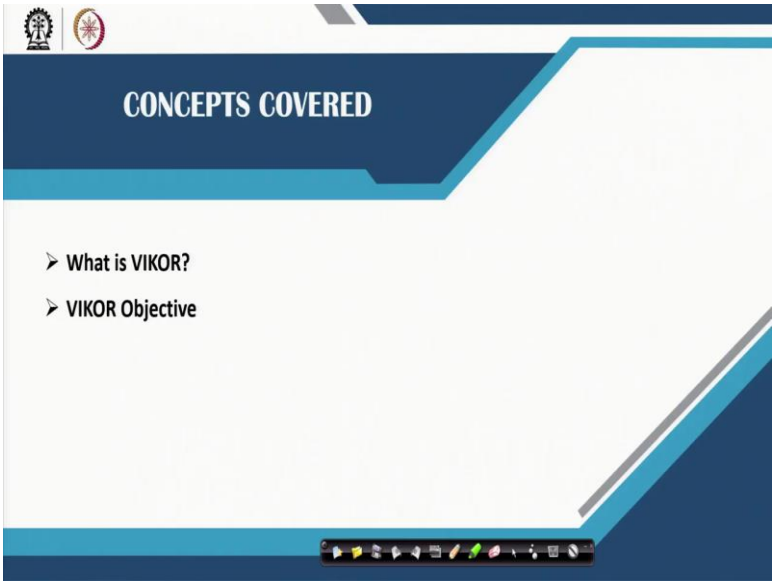

Now, having said this, let us have a brief recap of what was VIKOR and what is the VIKOR objectives. Now VIKOR as we said that we need to find out as human beings they have different preference criteria and it is not always possible for the human being to come up with one optimisation, specific optimisation issue, right. And that is where VIKOR comes into play, where what we find out is how far you are from the ideal point, okay. So that is where VIKOR comes in.

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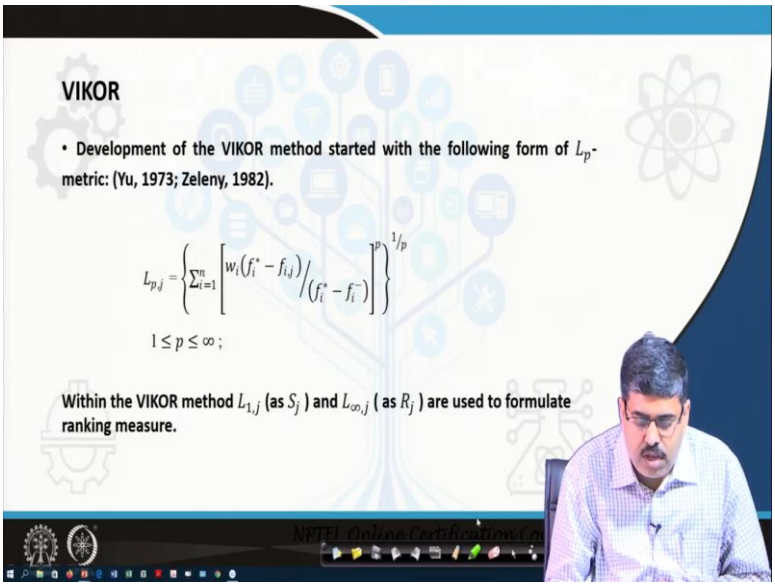

And we started off with, if you remember, we started off with something like this, that is what is the highest value and what is the lowest value, okay. What is the highest value, what is the highest value, what is the value at that particular cell? What is the highest value, what is

the lowest value at that particular cell. That is the range right, okay. Now so, and then when we moved on we came up with the criteria called Max and the Min criteria, this is all we have covered, okay.

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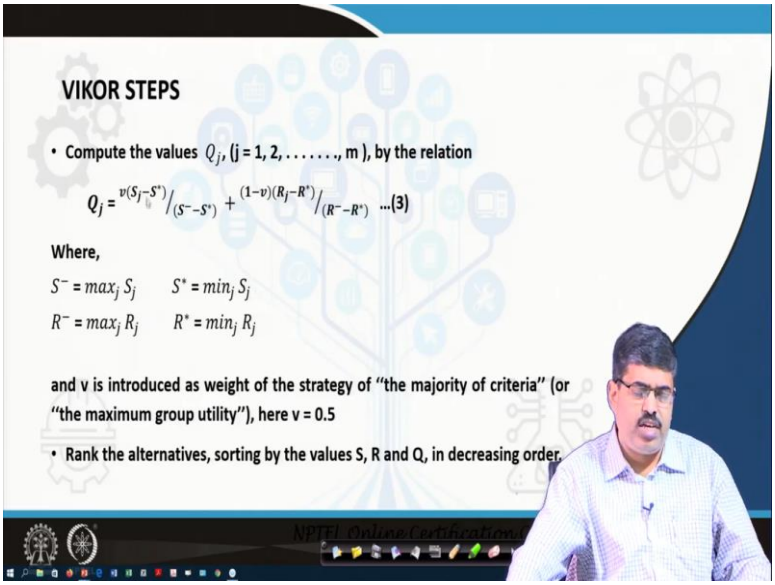

And then, now this, we are coming up today with a term called Q. Compute the values of Q, this is where we ended basically in the previous class. Qj that is Sj minus star, S minus minus S star, okay. That is 1 minus v, Rj minus R star, R minus minus R star, okay. So v is introduced as a weight of the strategy of the majority of criteria or the maximum group utility, here v is equal to 0.5. Rank the alternatives, sorting by the value S, R and Q in the decreasing order, okay.

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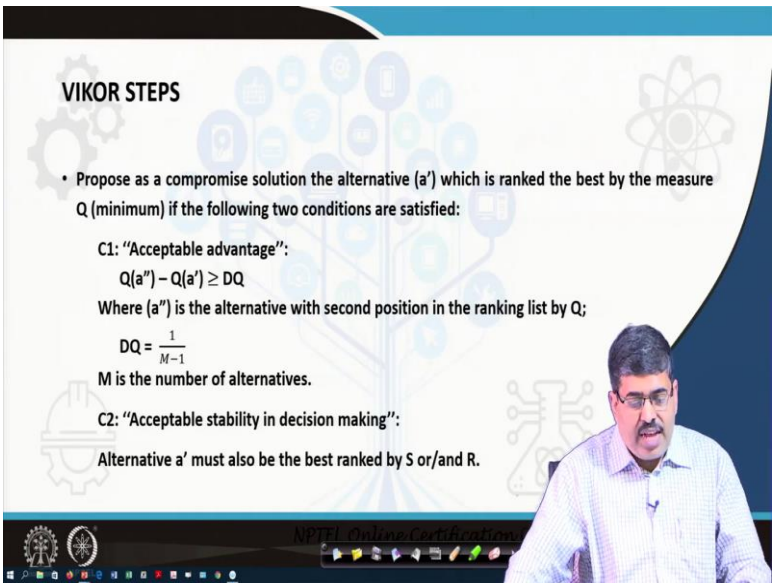

Now, acceptable advantage Q a double star minus Q a star should be greater than equal to DQ where a double star is the alternative with second position in the ranking list by Q and DQ is 1 minus M minus 1, 1 by M minus 1. M is the number of alternatives. C2, acceptable stability in decision-making. Alternative a prime must also be the best ranked by S and or capital R, okay.

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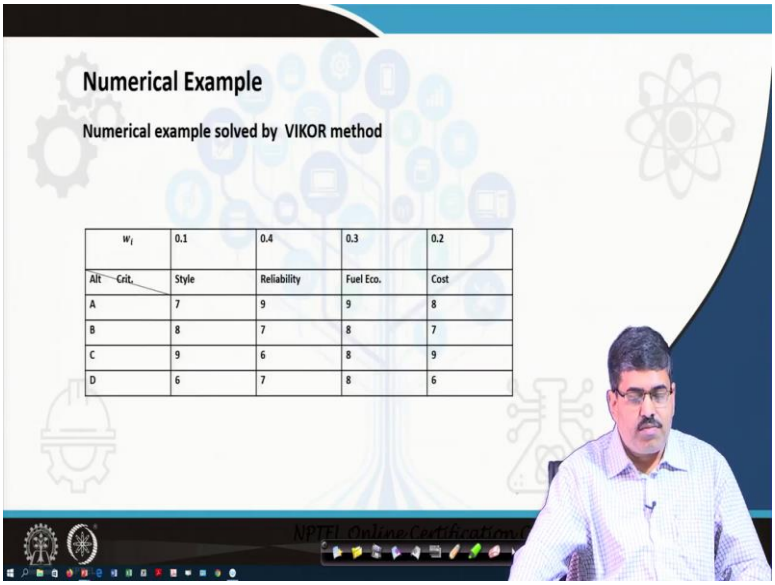

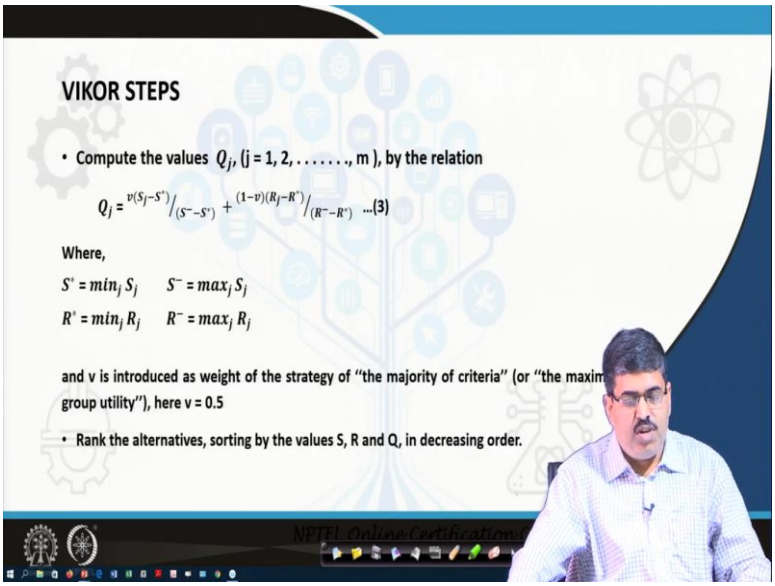

So this is the numerical example that we were doing in case you remember, if you remember, okay. So, and then this is the values. Compute the values. You have done this. Here we basically ended, right? And it is Qj, vS minus this formula, okay.

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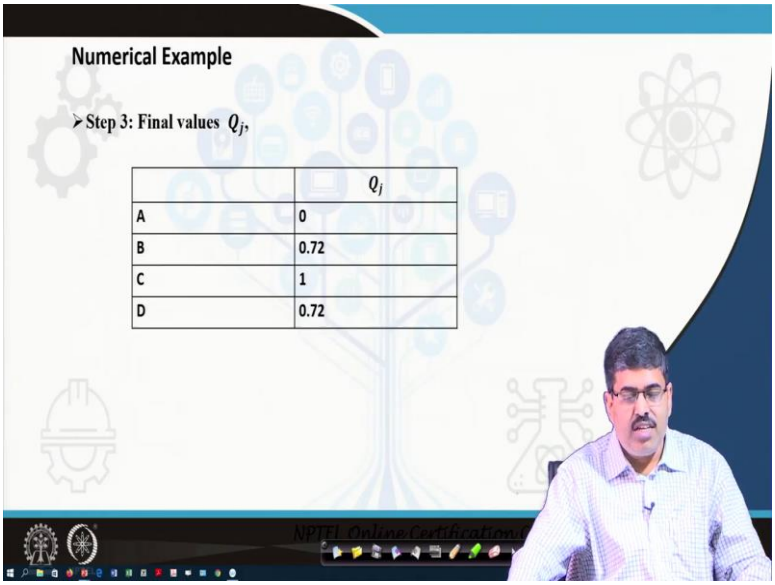

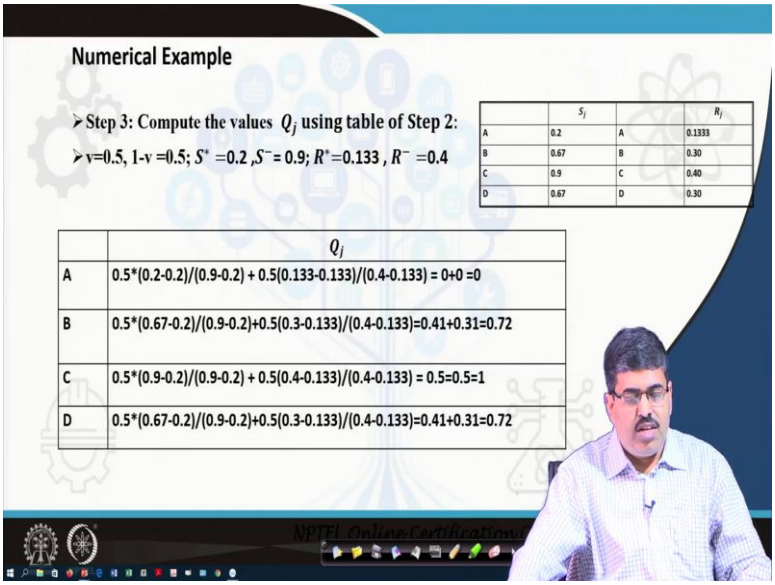

Now, having said this, this is the values of QJ, right. Now, this is just for numerical purpose, some portions here we have given the opposite, okay. And, right. So and final values of Q can be computed, right. So this portion is given the opposite, as I said, and this is just for reference purpose, this numerical example is just for reference purpose, you have to go through it very carefully.

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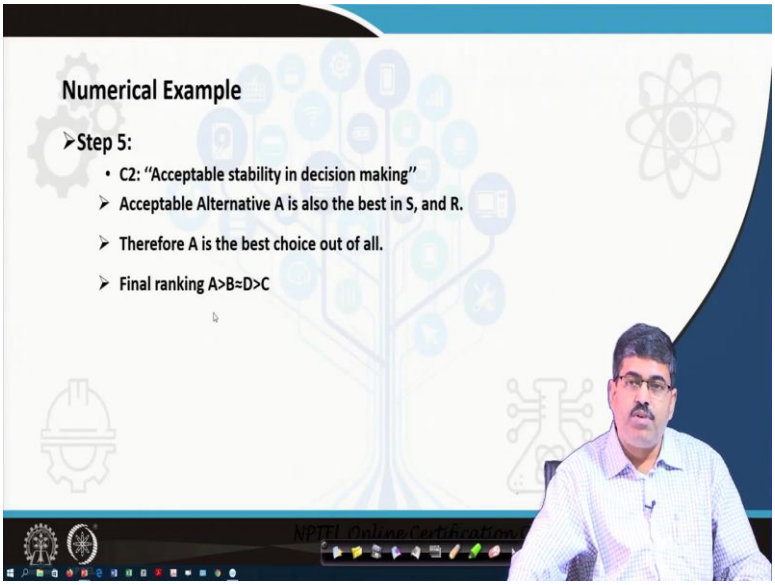

And acceptable stability, this is just for a reference purpose. Don't go by the numbers, the calculation methods, etcetera. So this is basically the VIKOR method, okay. There is nothing too rocket science in it.

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Next we will go, today we will move up to something called ISM method, okay. That is Interpretive Structural Modelling, okay.

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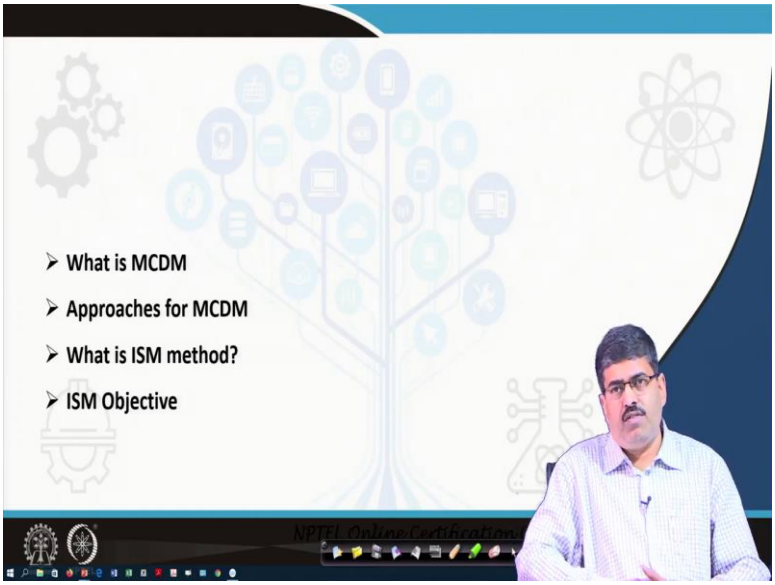

ISM method basically, as we will, again it is a basic introduction what is MCDM technique etcetera. You all know about it, multi criteria decision-making. Now, what is ISM method? ISM method basically finds out what is, if you have a relationship number one, if you have a reverse relationship, number two and the third is, so one is direct relationship, second is a reverse relationship and the third is whether there is a two-way relationship and the fourth is whether there is a zero relationship, okay.

So it is like, so just let me put it that way, it is like whether you have a direct relationship, whether you have a this way relationship, whether the relationship is two-way, and whether there is no relationship, so that is what is ISM method all about. What is the type of relationship, right.

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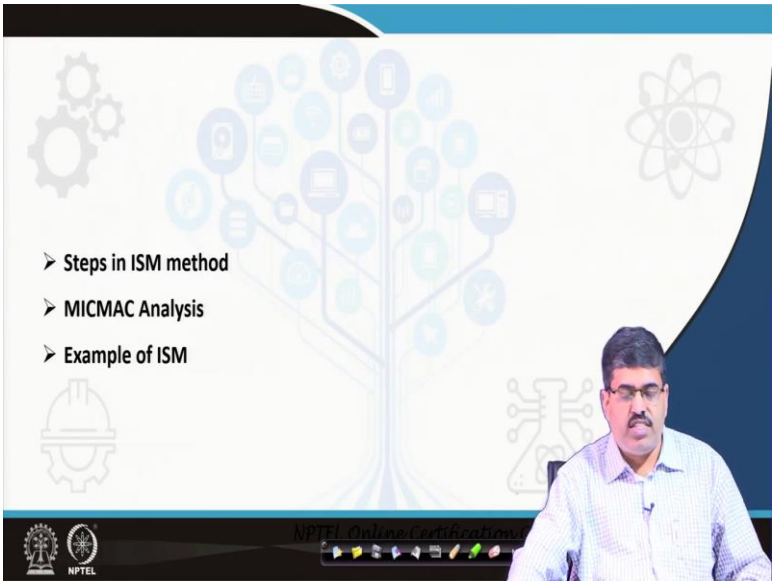

What is the steps, MICMAC analysis and examples of ISM, this is what we plan to cover. We may not be able to cover the entire thing in this week, we will be able to cover only in the next week.

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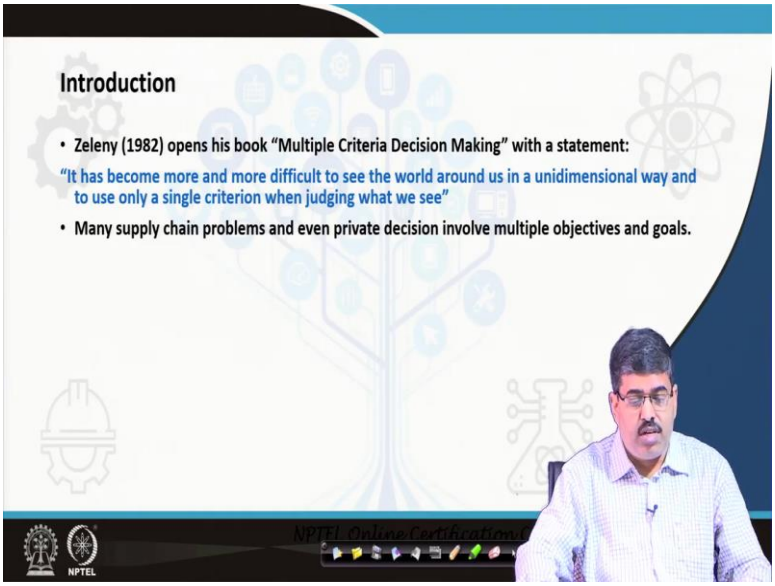

Now introduction this, it has become more and more difficult to see the world around us in a unidimensional way and to use only a single criterion when judging what we see, okay. Many supply chain problems and even private decisions involve multi objectives and goals, right. And we will see the real life also, as in the precious week I was giving you an example that I am going to the bus stop and then I am late for the examination, what do I do? That is a single criteria, I need speed but when I do not have such a hurry so many criteria come in. I need

comfort, I need value of money, the price should not be too high, so many other criteria come in the picture, so multi criteria is a way of life, okay.

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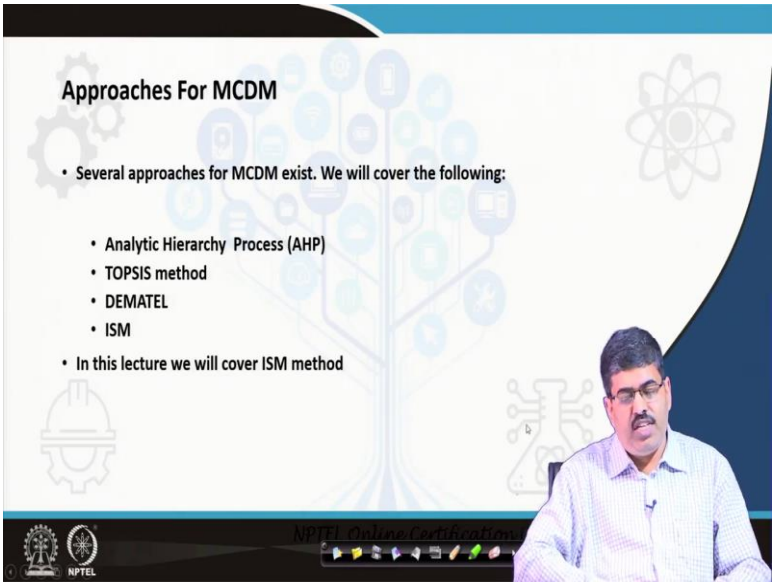

Approaches for MCDM. As we said AHP, TOPSIS, DEMATEL, ISM. So in this lecture we will cover the ISM method, right?

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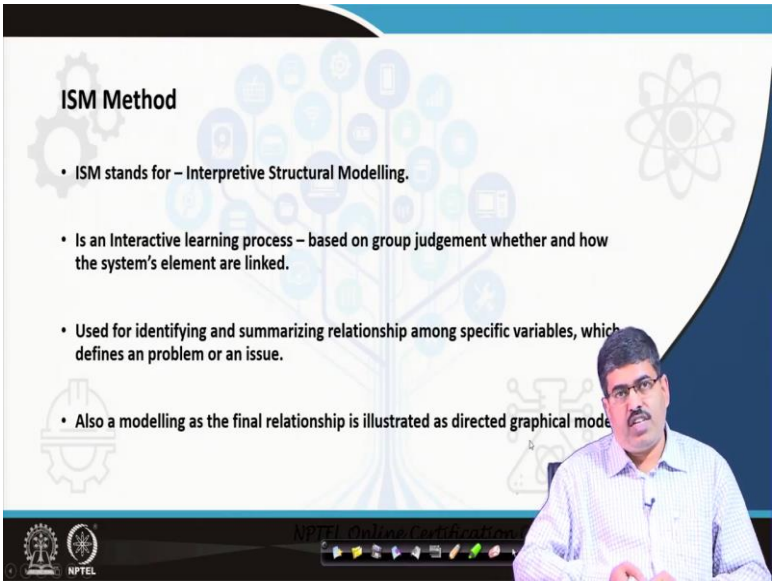

ISM stands for Interpretive Structural Modelling. It is an integrative learning process based on group judgement whether and how the system's elements are linked. It is an integrative learning process based on group judgement whether and how the system's elements are linked. It is used for identifying and summarizing the relationship among specific variables,

which defines a problem or an issue. Also a modelling as the final relationship is illustrated as directed graphical model, okay.

So as we said in the first case, let us go to the third bullet point. It is used for identifying and summarizing relationship among specific variables, which defines a problem or an issue, that an is a misprint, mistyped or rather typo. Defines a problem or an issue. Used for identifying and summarizing relationship among specific variables, which defines a problem or an issue, right, okay.

So as we were mentioning like, the thing here is that in earlier methods, as we say, what are different methods doing. Each and every method has its own way, it is different from the other method. So AHP had its own method of ranking, I am better than him, she is better than him, okay. Next method TOPSIS was used for preferential ranking, how far it is from the ideal solution and how far it is from the negative ideal solution. VIKOR was used assuming that people have a complex system of decision-making.

Similarly, Interpretive Structural Modelling it comes up with the basic question. It says okay, there is a direct relationship between X and Y, but is there a return relationship or a reverse relationship between Y and X, so this is what ISM is saying. There is a direct relationship, fine, there is a direct relationship, fine, okay. Just hold on. There is a direct relationship, is there an indirect relationship, okay, that is what this is asking. So this is the core of ISM method, okay.

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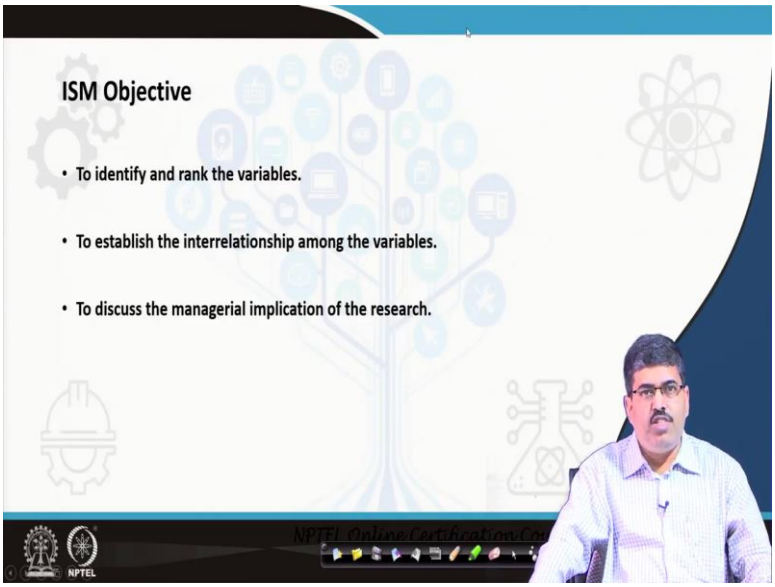

Now, identify objectives to identify and rank the variables. To establish the interrelationship between the variables. To discuss the managerial impact of the research, okay.

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There are 7 main steps in ISM method. Let us now proceed and try to understand this. Generation of structure self-interaction matrix. Development of Initial Reachability matrix. Formation of final reachability matrix, and level identification. Formation of a Diagram or Diagraph. Modelling, and MICMAC analysis. Of which we will try to finish of the first three or four in today's class. And in the next we will do the balance, right.

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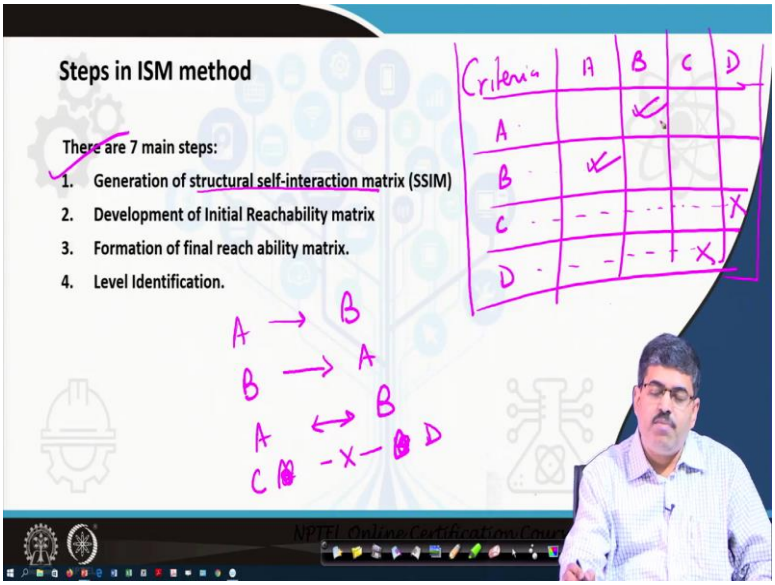

Okay, so first is generation of structural self-interaction matrix, okay. Now see, here there are criteria, okay. Let us say criteria, let us put A, B, C, D. Similarly, A, B, C, D right. A, B, C, D, let us put A, B, C, D, right, okay. Now, generation of structural self-interaction matrix. Now, what is important here is, let us say I am saying, let us be very clear this is a matrix, okay. What are you doing, we are doing step one, right? Now let us say, what is happening here is say, A is related to B, okay. B is related to A; A is related to B and B is related to A and A not at all related to B, right. So what are we saying? A is related to B, see A is related to B, B is related to A, A is related to B and B is related to A.

Sorry, A is related to B and B is related to A, both and second option A is not related to B, okay. Assume this is a different one, this is let us say, this is let us keep it at C and D. C and D, C is not related to D. Similarly, D is not related to C. So this is, if you see this is the type of relationship that is the structural self-interaction that we are talking about, right. This is a structural self-interaction that we are talking about, right. So this is single relation, two-way relation, single relation, two-way relation, right. Okay, done. Now, this is the way we are going about it, right. Now, but then if you see A is related to B, B is related to A, right. So, and A is related to B and both, so double take. So we have to distinguish them, right. So how do you distinguish them? That is coming up in the next stage, okay, that is coming up in the next stage, right.

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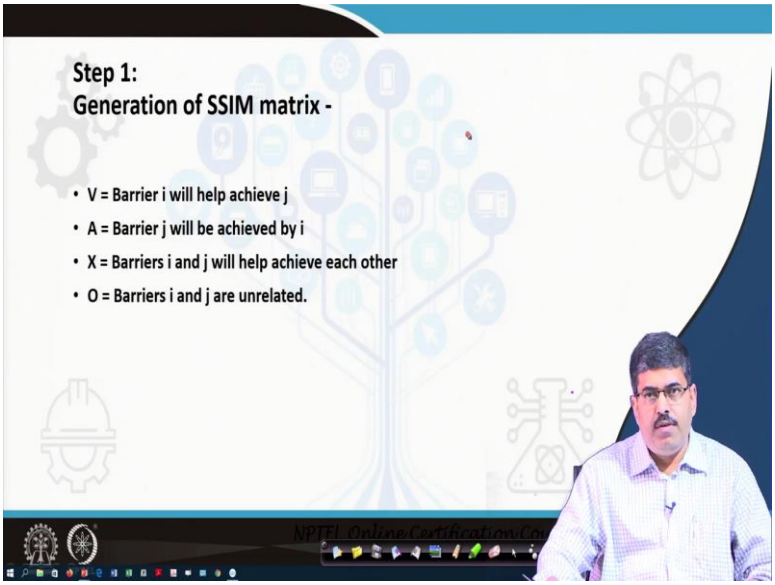

So when A is related to B, when there is a direct relationship, we give it a V. When there is a reverse relationship we call it A, when there is a both way relationship it is X, and when there is no relationship it is O. What are we saying? When there is a one way relationship going it is V, when there is a back relationship it is A, when there is no relationship it is X and when there is no relationship it is O. When there is two-way relationship it is X and when there is no relationship it is O, okay. We are just giving symbols to differentiate among them, right. We are just giving symbols to differentiate.

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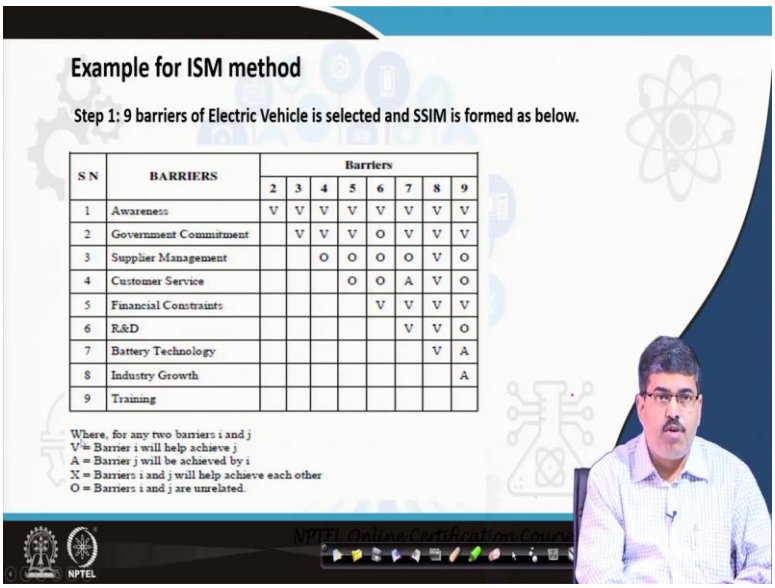

S N	BARRIERS	Barriers							
		2	3	4	5	6	7	8	9
1	Awareness	V	V	V	V	V	V	V	V
2	Government Commitment		V	V	V	O	V	V	V
3	Supplier Management			O	O	O	O	V	O
4	Customer Service				O	O	A	V	O
5	Financial Constraints					V	V	V	V
6	R&D						V	V	O
7	Battery Technology							V	A
8	Industry Growth								A
9	Training								

These are actually the steps we will do so we will just go by this. Now, this is an example, okay, this is an example and say awareness, okay, is related to, in this way we are giving V,

A, X, O. At the bottom you see V, A, X, O this is the relationship given. Awareness is related to government commitment, supplier management. We are not giving awareness-awareness, we could have given this way. So we could have done in that way, no need actually. Awareness is related to government commitment, that is what the proposition is, okay. Now, is government commitment related to awareness? No, that is why it is blank. It is not. Is government commitment related to awareness, no, okay. Next, supplier management. Is it related to customer service? No, so 0. So in this way we get a full-blown relationship matrix, in this way we get a full-blown relationship matrix, okay.

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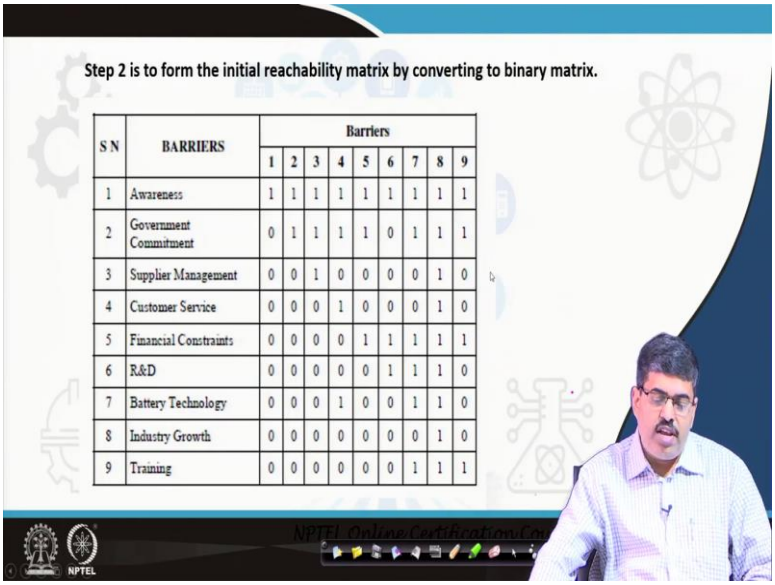

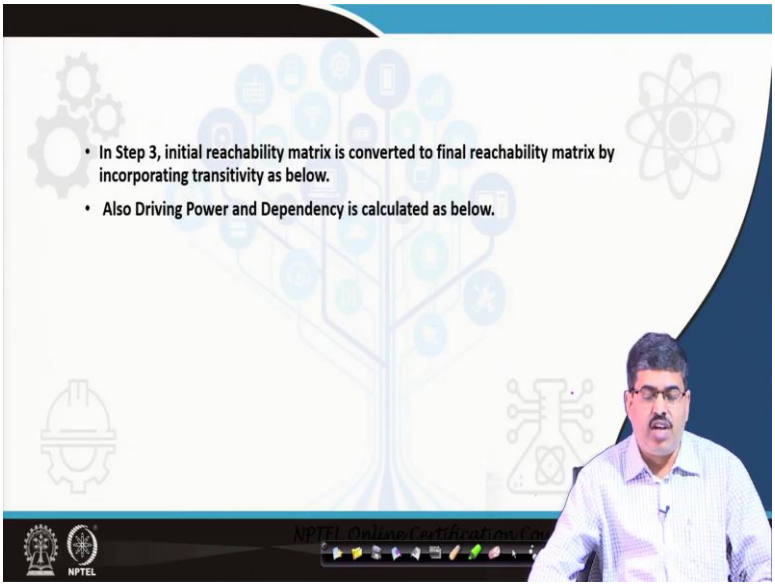

In the next step what do you do, wherever there is a relationship you put 1. Wherever there is no relationship, it is 0 okay. Wherever there is relationship you put 1, wherever there is no

relationship, it is 0. Okay. Now, in step 3, initial reachability matrix is converted to final reachability matrix by incorporating the transitivity as below. Look, this awareness matrix, how many ones have it got? It has got 9 ones. Let us go back, what are we saying? This was my matrix, original matrix, okay. This was my original matrix, right. 1, 2, 3, 4, 5, 6, 7, 8 and 1 is what? Awareness to awareness, so 9 Vs it has got. So, 1, 2, 3, 4, 5, 6, 7, 8, 9. 9Vs, right?

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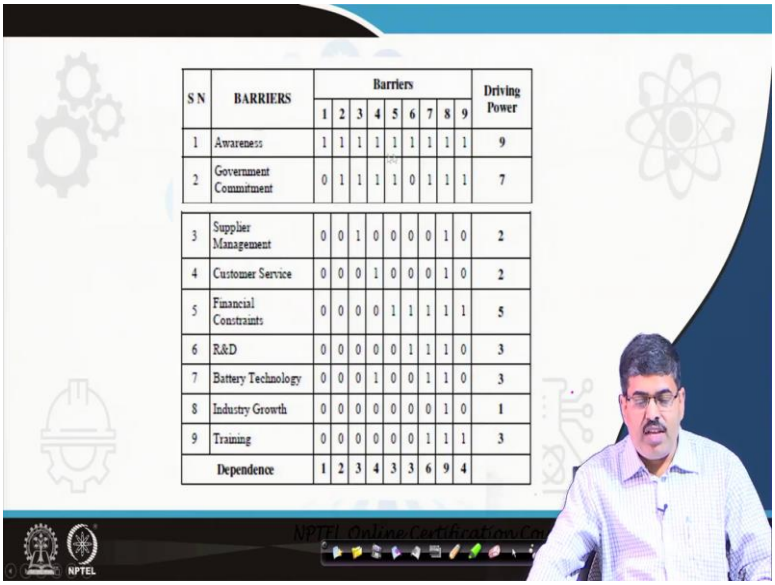

Now awareness is related to these 9 Vs, driving power is 9. Government it has got 7 ones, so driving power is 7 okay. So in this way all the ones that we have calculated that is why driving power. What is the dependency? This is the column total, so the row total is the driving power and the column total is the dependency, right. So row total is the driving power and column total is the dependency, okay. So this is the step 3, reachability matrix is converted into final reachability matrix by incorporating the transitivity below and also the driving power and dependency is calculated, right.

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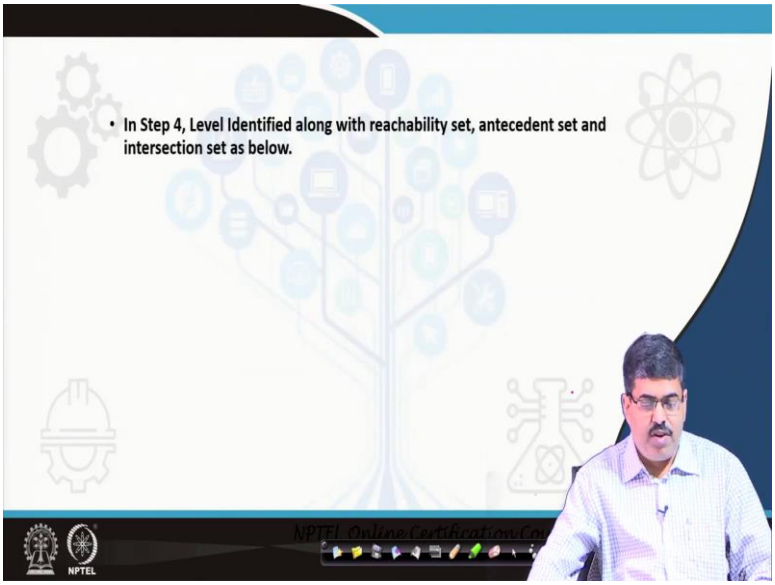

Now, in step 4 we have to identify the levels along with the reachability set, antecedent set and interaction set as below. Now here onwards, we will do in the next class, okay.

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Now, what the reference for this paper is Interpretive Structural Modelling Approach for, we have taken this problem from Interpretive Structural Modelling Approach for Development of Electric Vehicle Market in India by Digalwar and Giridhar okay. So in case you need a further reading you can go back to this paper. So this is, so what are we learnt up till today? Up till today we have learnt how to arrive at dependency factors and the driving power, number 1.

So what is it basically? It is basically you find out the relationship, V is i will help j, A is j is related to i, when both are double related it is like, the score is X and O means they are unrelated. So this is the matrix. Wherever there is a relationship you put it as 1. Next third step, wherever there is a relationship, count all the rows and see the driving power summation. Count all the columns see the driving power, that is summation, right. Up to this we have completed. Next we will calculate the level identification, right, okay. And then we will move on to get a set. So we will end today's lecture here. Next class we will continue with ISM and we will complete the MCDM techniques that are there. Thank you.