Decision Support System for Managers
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Week – 12
Module – 02
Lecture – 56
Decision Support Systems for Operations Management (Contd.)

Hi! Welcome to our second module of the last week related to the course on "Decision Support Systems". So, we will take on from where we had left; we were discussing about the deployment of Analytic Hierarchy Methods, AHP technique in 'Operations Management' domain.

And today we are going to discuss about the application of AHP techniques for rating suppliers. This vendor rating is a very important problem faced by operations management group in any organization. So, supplier selection or supplier rating requires multiple criteria and we have to select the best possible supplier, which satisfies all the criteria.

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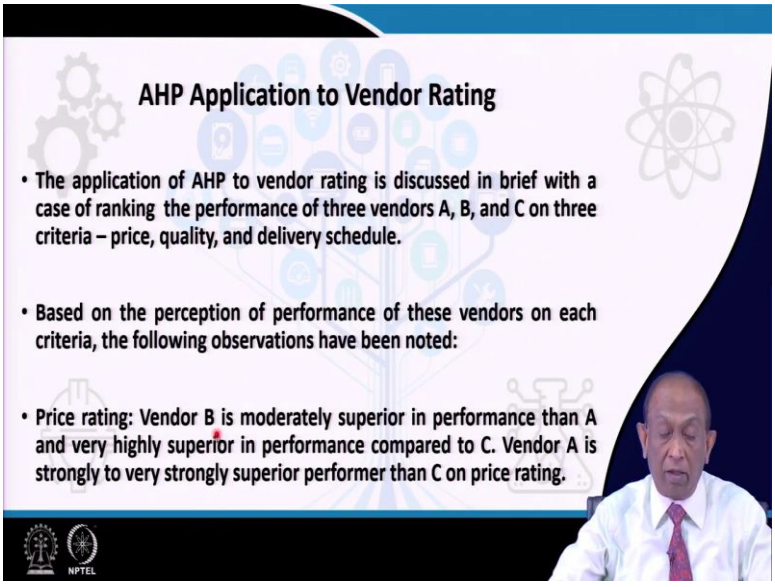

So, the application of AHP technique for supplier rating will be discussed in brief with the help of a case related to ranking the performance of three vendors A, B, and C so; that means, we have three alternatives A, B, and C. And, we have three criteria the price of the items supplied by the supplier, the quality of items supplied by the suppliers, and delivery schedule.

That means, whether the suppliers are confirming to the delivery date specified by the company. It is a very simple problem for the sake of illustration three alternative suppliers are there for the sake of illustration we have name the suppliers as A, B, and C three alternatives.

And there are three criteria: 'price' that is price of the item supplied by the supplier, 'quality' of the item supplied by the supplier, and the 'delivery schedule' that is conferment's to the delivery date by the supplier. Based on the performance of these vendors on each of these criteria, the following observations have been noted. What are those observations?

Price rating say with respect to price with respect to price vendor B is moderately superior in performance compared to A. The same vendor B is very highly superior in performance compared to C. And, vendor A is strongly to very strongly superior performer than C on price rating fine.

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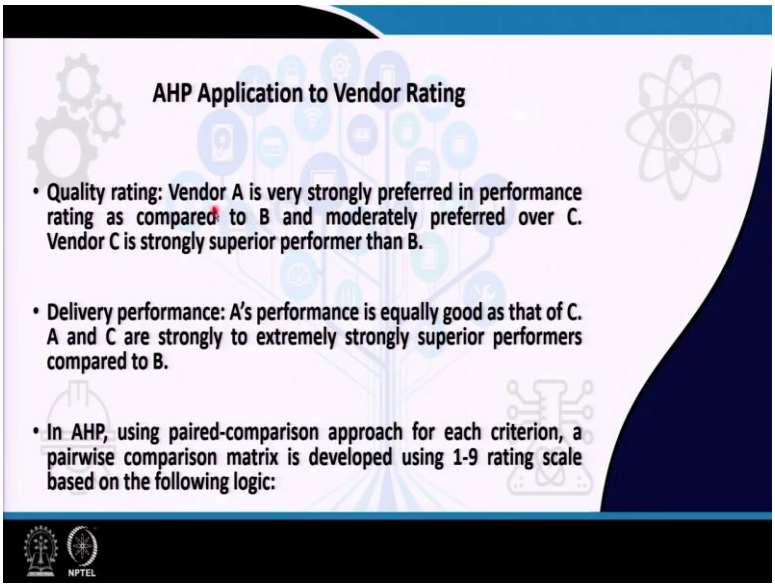

Next with respect to quality vendor A is very strongly preferred in performance rating as compared to vendor B and vendor A is moderately preferred over C. And, vendor C is strongly superior performer than B. When we look at the criteria of delivery performance based on the past data, we have noted that A's performance is equally good as that of C.

And A and C are strongly to extremely strongly superior performers compared to B. So, how do we set up the preference matrix under such situation? Because, first thing that we have to

do that within each of these criteria that is price quality and delivery performance we have to rank the suppliers.

In their order of importance based on the perceptions that we have noted and these perceptions have been developed based on their performance of the suppliers over a given period. And, you see there are some languages that are used, very strongly preferred, moderately preferred. So, based on these descriptions. We have to find a quantitative measure a scale to find the relative importance, when we perform a pairwise comparison matrix.

So, in AHP, we have to use paired-comparison approach and the pairwise comparison matrix needs to be developed using a 1 to 9 rating scale and that rating scale also is based on the following logic proposed by Saaty.

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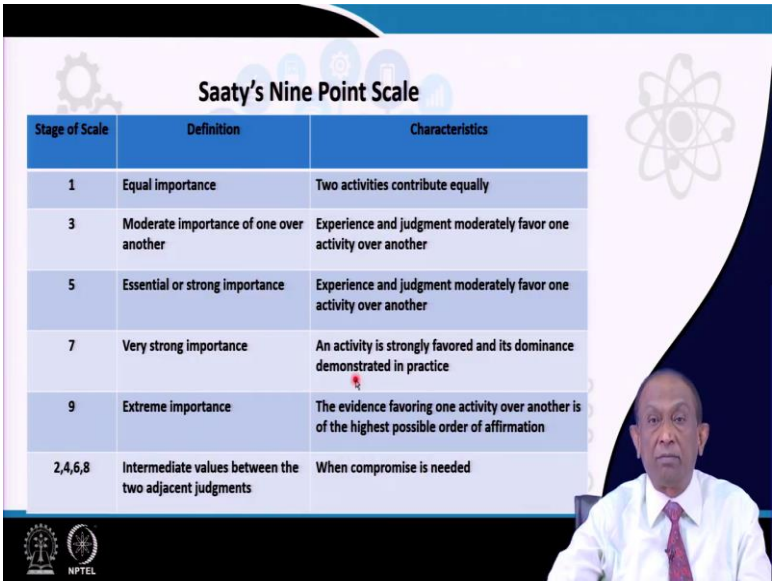

Like this is Saaty's 9 point scale. In the pairwise comparison matrix that we will be formulating a cell entry will get a value of 1, if the 2 alternatives under a criteria are of equal importance.

So, whenever there is equal importance, the rating will be one in the corresponding cell; that means, two activities contribute equally with respect to the given criteria. The comparison matrix will have a cell entry 3, when within one criteria, one alternative has got moderate importance over the other. So, in case of moderate importance of one over another, the cell entry will become 3.

And, how do you basically say that it is moderate importance? This is based on this particular characteristic that experience and judgment moderately favor one activity over another. When the relative importance of one criteria over the other is described by the strong importance, essential or strong importance, then the cell entry gets a value of 5.

During paired comparison, when an activity is strongly favored and it is dominance is demonstrated in practice. We define one activity is very strongly important compared to the other. And, the corresponding scale is 7. A cell entry of 9 takes place, when one alternative is extremely important compared to the other that is the evidence favoring one activity over another and the evidence is of the highest possible order of affirmation. Then the cell entry becomes 9.

And, when a situation arises where some compromise is needed we use intermediate values between the two adjacent adjustments that is 2 4 6 8 in between, intermediate values between the two adjacent judgments is expressed by intermediate values.

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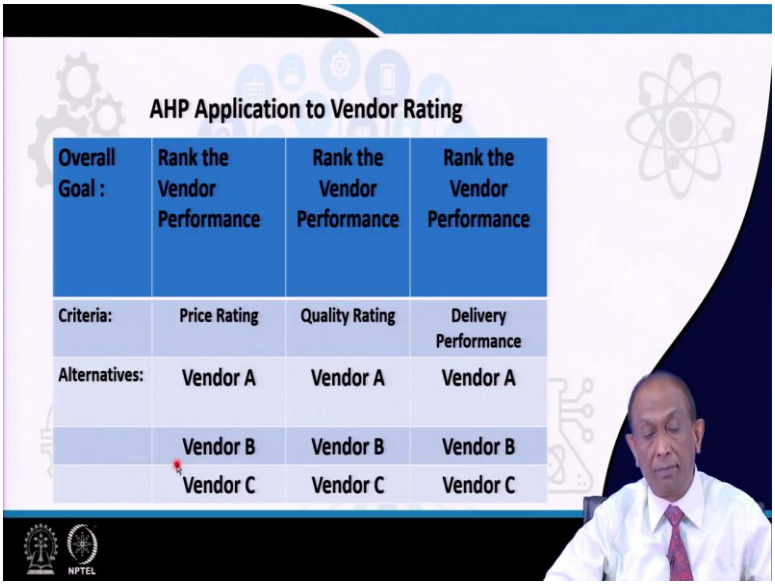

So, basically we have to do pairwise comparison between these suppliers under the criteria of price rating, quality rating, and delivery performance. Within each of this criteria we are going to determine, the relative ranking of the suppliers based on their performance. And, also we have to develop another pairwise comparison matrix considering all the criteria; that means, among price, quality, and delivery, which one is more important. And, the overall is goal is to select or rank the best possible supplier.

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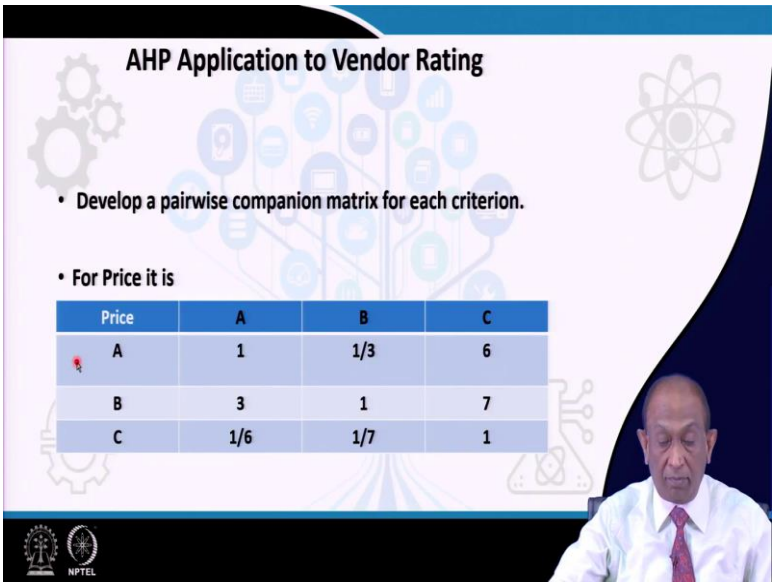

So, based on the perceptions that we have already stated, we have to develop a pairwise comparison matrix under each criteria. So, with respect to price, we get this particular comparison matrix now you see with respect to price supplier bs performance over a is given by a cell entry of 3. What do we mean by cell entry of 3 moderate importance? And, when you look at this vendor B is moderately superior in performance compared to A.

Look at the statement vendor B is highly superior in performance compared to C, highly superior means very strongly superior. So, the scale is 7. So, B is 7. Let us see how did we get this value of 6? Again, we go back try to see, that with respect to price vendor A is strongly to very strongly superior performer than C on price rating. So; that means, somewhere in between strongly to very strongly superior. So, that is somewhere in between 5 and 7, 7 is very strong and 5 is strong.

So, somewhere in between is a compromising situation and that is why some intermediate value of 6 has been used, when we are developing this pairwise comparison matrix.

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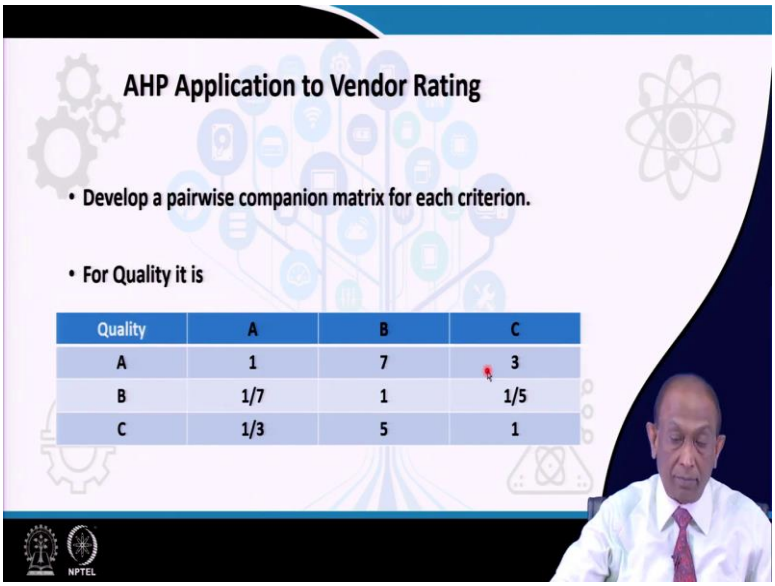

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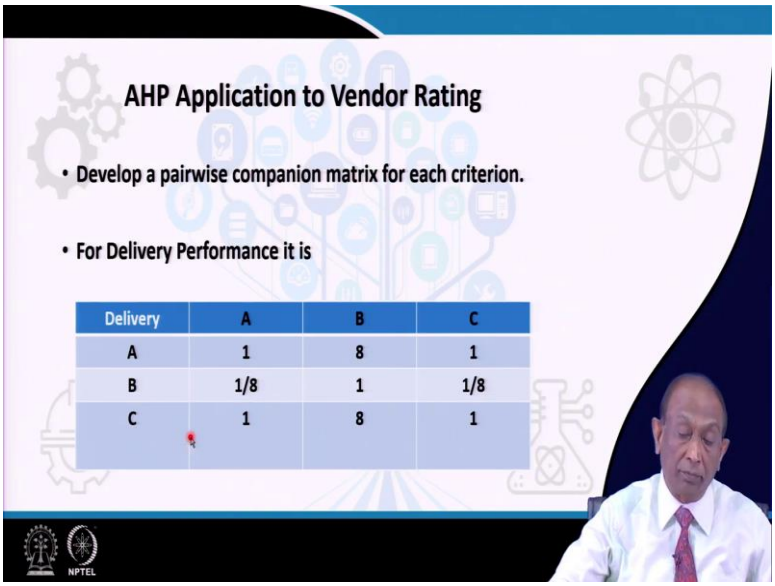

For quality this is the matrix and for delivery performance based on the perception, this is the matrix.

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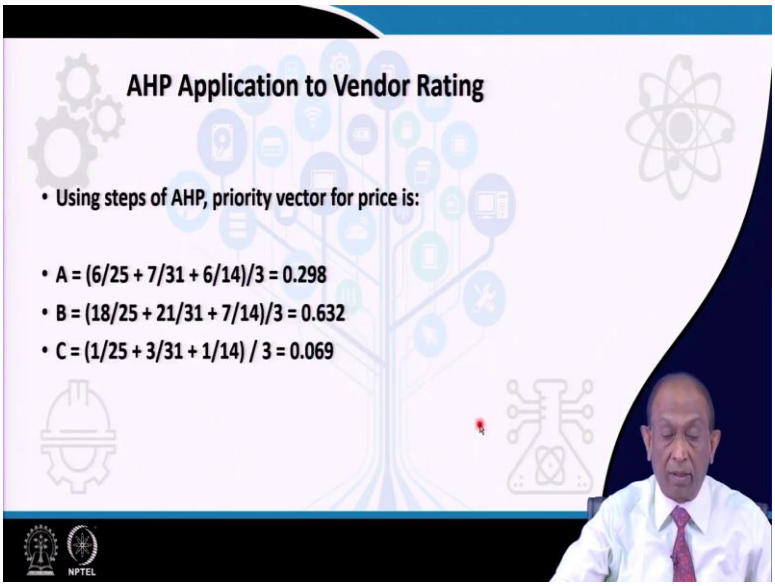

So, as we had discussed in the last session, using steps of the analytic hierarchy process priority vector for price is this. How did we get this? We have added these columns that is 1 plus 3 4 plus 1 by 6, that is 25 by 6 is the column sum and then we divide each of this element by this column sum. Similar thing we have to do it for this column we have to add up all these elements, find out this column sum and then divide each of these elements by this column sum, similar is in case of this particular column.

So, here the column sum will be 14, 6 plus 7, 13 plus 14. So, each of these elements will get a value of 6 by 14, 7 by 14, 1 by 14. Once, we get that we will add them and divide it by 3 to get the row average. So, that is what has been done to get the priority vector for price.

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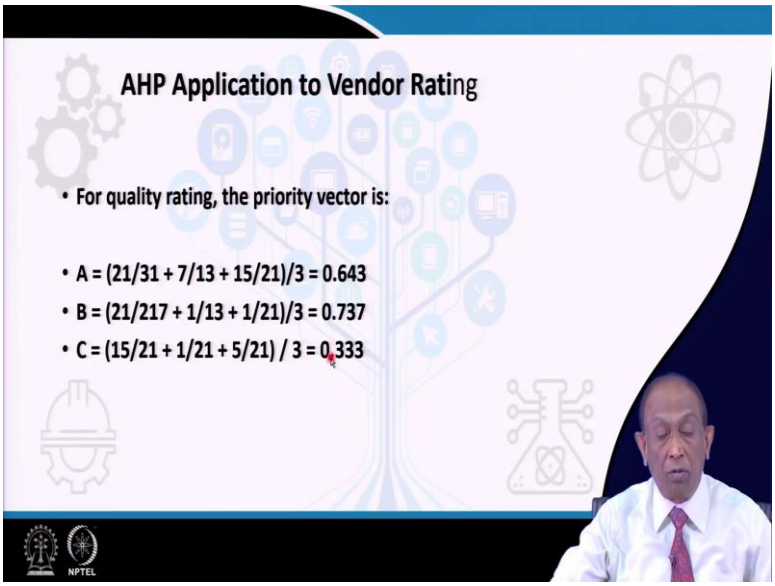

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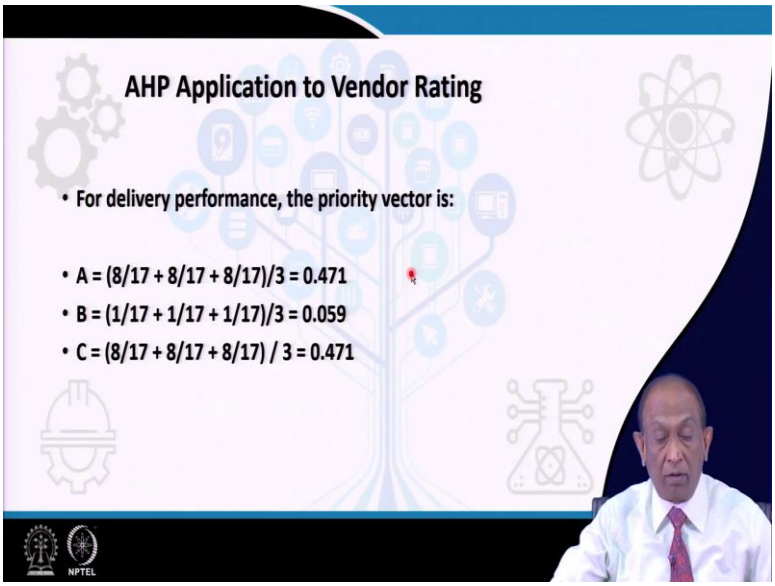

Same we have to do for quality. So, for quality rating the priority vector is this one and for delivery performance the priority vector is this.

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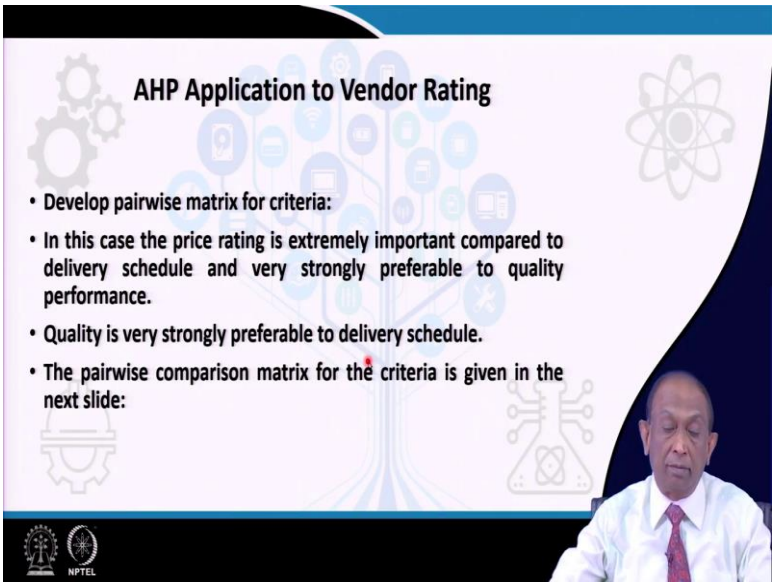

Then, we have to develop pairwise matrix for the criteria. So, in this case the decision makers; that means, the top management in the operations group, they have expressed that the price rating is extremely important compared to delivery schedule and very strongly preferable to quality performance for that company. Quality is very strongly preferable to delivery schedule. So, based on this we will develop the pairwise comparison matrix for the criteria.

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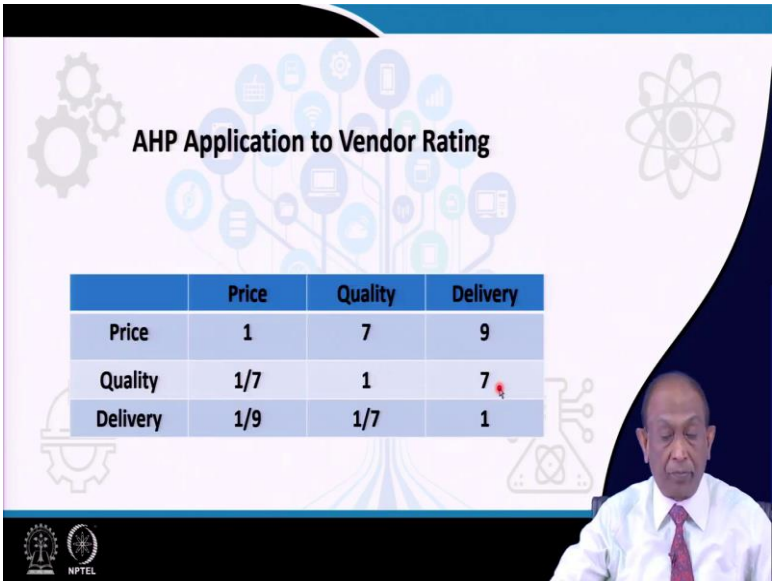

So, this is the matrix using the Saaty scale. Once, we get this matrix, then in a similar manner we will find out the priority vector for ranking these criterias. So, what we do with respect to these column we sum up all these elements find out the column sum, then divide each element with this column sum. We do the similar things for this column, and for this column, and then we take the row averages, and that row averages will give us the priority vector for the criteria and we will get that criteria matrix.

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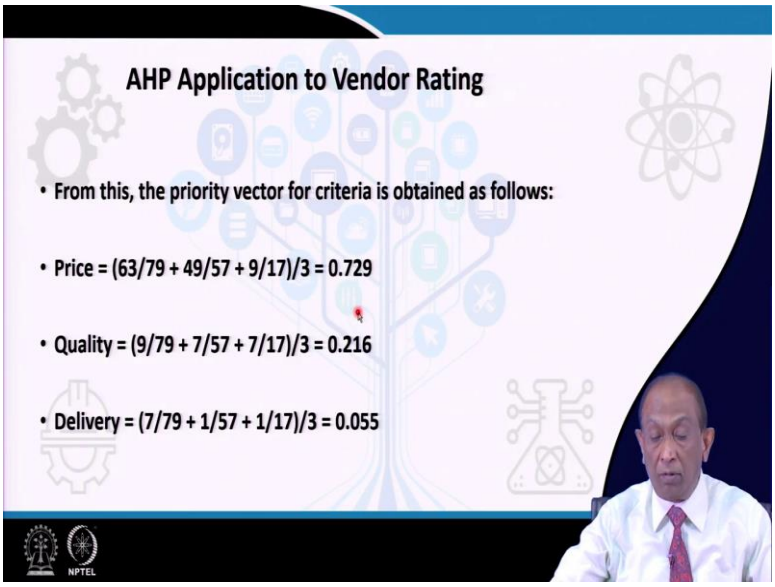

So, from this the priority vector for criteria is obtained as this. So, from this it is very clear, that price is the most important thing. Next to price is the quality and for that company delivery performance is the third priority. Now, once the relative importance of the criteria are determined through this pairwise comparison matrix, then what we will do?

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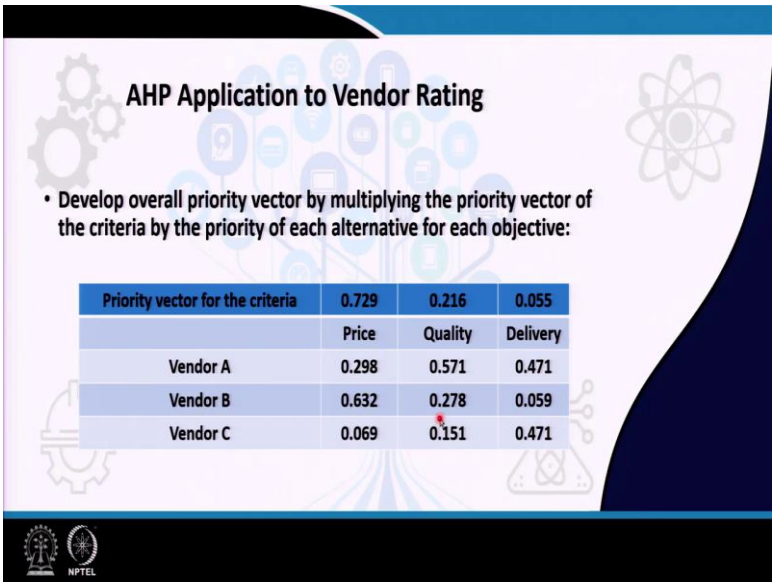

We develop overall priority vector by multiplying the priority vector of the criteria by the priority of each alternative for each objective. So, priority vector for the criteria we have already shown you 0.729, 0.216, 0.055. So, this is that priority vector for the criteria. And, this comparison matrix for the alternatives with respect to each criteria the preference vectors are like this. So, these two matrix we have already got.

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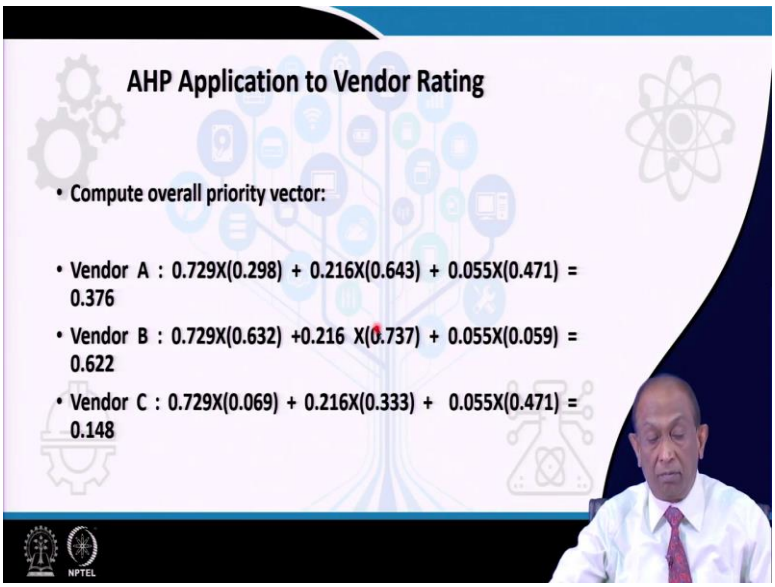

So, now what will you do? You will multiply this vector with this matrix, that will give you the overall priority vector. So, for vendor A the score is 0.376, for vendor B the score is 0.622 and for vendor C the score is 0.148.

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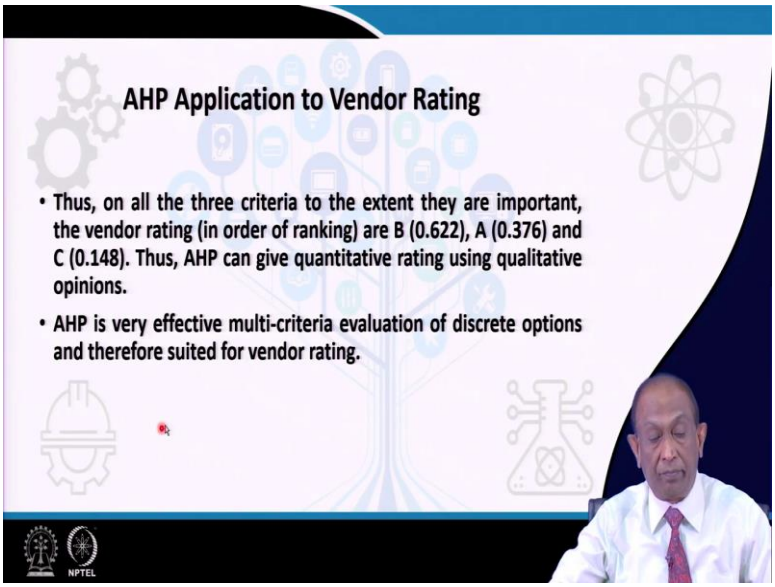

So, which vendor is the best? Thus, considering all the three criteria to the extent they are important the vendor rating in the order of ranking are B, then A and then C. Thus, AHP can give quantitative rating using qualitative opinions.

AHP is a very effective multi-criteria evaluation technique when discrete options need to be considered and therefore, highly suited for this kind of applications where we have to select the best supplier among the competing ones. Again the references are the same when we discussed about the concept of AHP.

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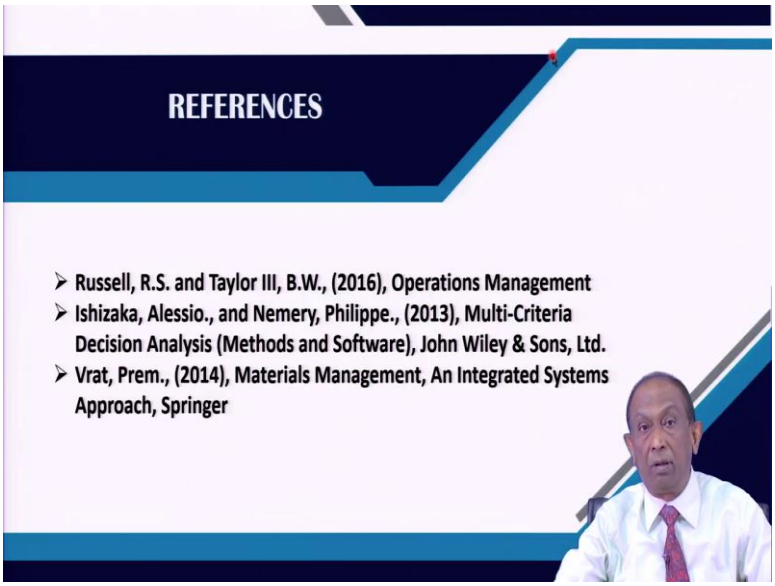

Thank you all for your patience!