Module No # 2
Lecture No # 07
Project Risk Management

Welcome back to all my students this is the seventh lecture which is the second lecture for the second week. So as I was discussing the risk concept and it is implication for a project management for a perspective is very important to understand and when you trying to basically understand the concept of risk to briefly go through the last slide of the last class.

It has basically what are the concept of risk how risk consequence can be basically mapped or understood considering different type of probability distributions and how the risk mitigation can be done and how the documentation and the learning process can be utilized.

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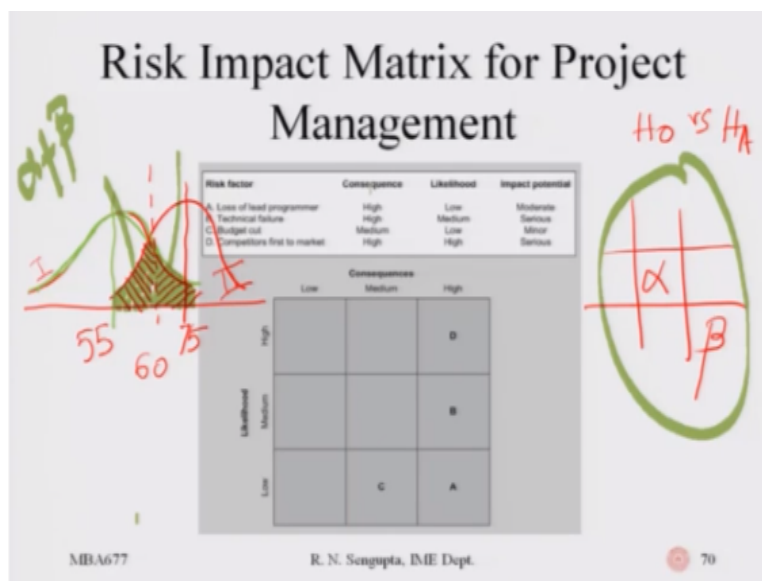
So if you come to this slide just after my last class is basically needs the risk impact matrix for project management concept. So you will basically have the consequence and likelihood of how the project is being implemented. Now if you look at the other matrix on the y-axis which is this part which I have here is basically the likelihood and on the top portion which is so called x-axis with the consequences and there that six the nine differentials not six sorry which basically are

the combinations of high and low to high and high and to the bottom being low and low to low and high.

So I will request my mind students to pause here for a one minute now let us go into the concept of probability. So I am sure people would have learned probability the concept of inference technique and which leads into the concept of hypothesis testing in other testing what we have we have basically an hypothesis is there which is basically the suggested one H0 and the based on that we have an alternate hypothesis which we try to check against H0 which is known as HA.

Now when you are going the concept of H0 and HA if you remember people who are studied probability and statistics there are two different errors. So the errors are if you remember the chart looks like not exactly like the matrix here but it looks like this very we have an error. Am not going to mark the top row and the left most column what I am interested note is basically with the values of alpha and beta which are the risk of type one and type two generally we know as type one risk and type two risk or an alpha and beta.

So if you look at an example now this example which I am going to give may not be very much directly relevant to project management work as such but it will be a good idea that how the concept of probabilities and have this resting can be utilized. Consider the example that the project as such is trying to give a loan to different set of people who are applied for a loan in a bank. So it can be given as an example for a good financial decision making process can be given as an example for a good concept of how probabilities can be used for a project.

So consider the bank manager has with him or her the set of papers which has been given by each and every person who is applying for a loan. So those set of papers have been supplied the bank manager to individuals or the people who are applying of the loan and they have filled it back and give it to the manager. Now as per the non on the bank consider hypothetically it is United Bank of India or BOB Bank of Baroda or SBA whatever you consider.

It can be syndicate bank the Punjab National Bank and so on and henceforth now consider the overall score the bank manager have been told based on which the loan can be given is sixty out

of hundred. Now let us draw a diagram in order to make a very good picture of what it means if you see there is let me try to basically change the color. So it will give you a good picture so this is the first part which is green in color this is the red part. Now let me also highlight few other things consider this is the average of the first curve on the left which is green. Let us consider the average of the second curve which is one right which is left at the red one.

And also let us consider the average point of which the loan would be taken which I mentioned few seconds back is sixty. Now concentrate on now I am not going to change the color just market in order to explain the example. So please I am sure my students would understand so the consider this is first part graph and this is the second part. Now if you look the second graph which is red in color it means those set of people who are able to repay back the loan because their overall rating is higher and consider this is seventy five.

This is I am just taking arbitrary values on the other hand the green graph mean basically means the set of people who if given the loan are not able to repay back consider this score is fifty five. So this fifty five this sixty seventy five are just arbitrary values for us to understand. Now concentrate on these two hashed areas so I have basically done in opposite diagonal direction if you will notice this part if it is possible let me change the color because now it is relevant that we change the color yes.

So this portion which marked this I am using a much bolder tipped electronic pen so this mark which is dark in color actually feel pay attention to that it means the set of people who would have been able to repay back the loan but they are denied the loan because their score here if you see. I do not want to mark it because the color would again comment to make in between many messy.

So these scores are less than sixty even on their average score is seventy though they are derived alone which means this is an opportunity cost loss for the bank. Now consider that with respect to the second portion which is here if possible again let me try to highlight the color this one is you know it is still fine later I will go here. So this portion consider this one I am sorry the color differentiation is not happening I apologize.

So if this portion which I had marked it means this the set of people or the probability that the person should have been denied the loan but he is given the loan which is a bad loss for the company. Now with this example if you consider and come back to this table which are shown which is technically used in the area of hypothesis testing this alpha and beta can be made from this diagram also where one area would be alpha and one area would be beta which would technically means that I am basically incurring type one and type two type of errors.

Such that any error reduction would be basically give me a benefit that means if you go back to the first so called example which have discussed in the sixth class that is the first class of the second week where the probability was given of completion or getting the material right on time was ninety percent and ten percent that there was a delay and then obviously there would be a cost of two thousand if you remember.

So if you try to basically understand that with respect to this example if would means that they would be an error for each and every decision process. Alpha and Beta trying to reduce alpha and beta would obviously be good for your decision making process for the project but there is a catch here. Considering the normal distribution which have used and drawn here in this green one and the red one.

If you try to shift the line which is the vertical sixty you will see that the overall area of alpha and beta are not reduced at the same time. So if you reduce alpha that means if take sixty on to the left from my side that means it is going more towards fifty five that means one of the area which is there the left hand side will start decreasing but on the other hand the other area would start increasing.

So trying to basically minimize both of them in concept of half of this testing is never possible. So what we try to basically that we try to basically reduce the overall risk which is basically alpha and beta and there are different technique in statistics if you do that now with that if you come back to this example or the table which is drawn on slide number seventy here.

It means there is a low medium and high low medium and high consequences also so this is a very simple case of a discrete case where there are three outputs and the example which I just drew was basically the concept of the continuous distribution of the normal case. Now as you have this char what you will do is try to basically mark them into different probabilities like what is the likelihood of the work being completed within ninety days.

The example which is discussed in the last class that means the sixth one so there is a time period an average time was ninety. So obviously you can either exceed or you can basically be able to finish the work before ninety. So if this probabilities are given and what are the consequence will also try to understand from the point of view creation of budget being exceeded the amount of material being used much more or whether they would be in technical difficulties or whether you are trying to use different type of resources like man, machine so and so henceforth.

So all these consequences would be drawn on this table considering that the overall project is in there in front of you. Obviously you can break this this table into more macro levels for each and every activity which will be comprising and making up the overall project. So if you consider the risk factor would be loss of lead programmer that these are the consequences but obviously they would have been effect on the quantitative sense we will see that later on.

So there would be technical failures there would be budget cost they would be competitors first in the market and the consequence can be either high or low depending on whatever project we are doing due and likelihood and the impact potential would also be analyzed by the project manager team. The project manager the project supervisor and the organizational manager who has a vertical and horizontal HR relationship with the project team as such.

Because if you remember I did mention time and again in the fifth class and also briefly in the sixth class that the overall concept of the project management team as such is functioning in such a way that is overall objective is to meet the organization objective. So these impact potential, likelihood potential and the consequences which you see here in both the matrix as well as the top table would be high and low depending how you have been able to quantify the overall risk.

If you want to basically be much more stringent so obviously we will try to make more categories of high very high low very low concept of risk and the consequence would also be mapped correspondingly in order to understand the picture in better light. So once the probabilities are given you will try to find out what are the effects which you have on a scale of say for example 0 to 1 or 0 to hundred or 0 to 10 whatever it is.

And then try to find out the probabilities accordingly once the probabilities are found out then again going back to the last example will try to find out what are the delay cost per day considering the linear order linear cost then try to multiply by the number of days considering it is either a independent structure of probability or dependent structure of probability and try to find out the overall risk or the loss.

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Strategies when Risk is there in Project

- Accept Risk as it is
- Minimize Risk to the maximum possible extent
- Share Risk with other parties involved in the Project Management work
- Transfer Risk to other parties (who may not be a part of the project management work)

Strategies when risk is there in the project first task is accept risk is there because risk is what basically means there is some amount of variations and if it is a non-deterministic process. Obviously all decision making process are non-deterministic and in project management obviously you will have different type of stochastic or non-deterministic process or events. So if there is risk accept it and if you accept it you basically make your plan accordingly.

So if there is delay you will basically consider that there is a delay and do it accordingly another way would be basically considering the risk is there you cannot make it zero try to make it

minimize it. So minimization can be trying to basically dovetail the work in such a way that two of them work and start consequently or subsequently such that there is no mis-utilization of the resources in the sense that the utilizations of the resources are done in such a way that one resource utilization in event one or or work one or job one does not utilization of resources for job two or event.

Share the risk with the other part is involved so if there is a risk for say for example from your side so try to basically pass it on to the vendor obviously they would be contract for that such that if there is a risk being borne by the vendor. Vendor would also get some benefit so there you basically try to share the risk in such a way that overall job descriptions and job distribution.

I am using the word job in a very layman sense that the overall project work has been broken down different components as the submacro work is done by different vendors or the different departments such the overall risk is reduced. Transfer risk to other parts who may not be a part of the project so it can be say for example even finance we can go by trying to buy different type of derivative different type of forwards and features such that the overall risk in the project is reduce.

Consider this example you have an oil exploration coming up and you know that within few months you want to would be enable position to tap the oil and sell them the oil in the crude as a crude in the market. But consider that oil as of now (()) (16:36) consider is one thirty US dollars per barrel. But you think that one once the three months period is up where you have already invested the huge amount of money suddenly there is a chance of the oil prices may crash.

So what you will try to do that try to find out different type of derivatives which are there in the market forwards in the market call options which are there put options which are there try to basically formulate your strategy of selling the oil in the market using different type of derivatives such that you do not make a loss in the sense the oil prices suddenly falls you are not force to sell the oil at the low price.

But obviously there would be a flip side also incase the price is increases you would definitely be in a position to sell the price at the higher price. So obviously if you want to get the benefit on both the account you have to make some addition cost in trying to buy different type of financial instrument to mitigate this overall negative impact. So the word negative impact I am trying to utilize in the sense that any downward movement of the price is back for you or any upward movement of the price which you cannot utilize is also bad for you.

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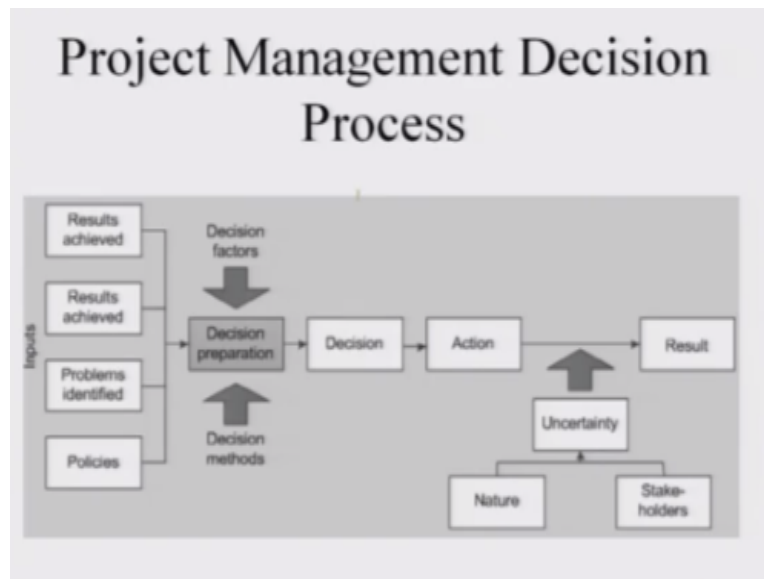
So you would always try to basically get the benefit of both the product. So if you see the overall layout of the process they would be decision factor and this is in a methods who to basically affect your decision preparation stage and they would be inputs coming from different angles it can be from the project management team their vendors it can be from the design team it can be from the HR perspective it can be say for example from the sales perspective and based on all the design factors the design methods.

What are the decisions? What is the political environment? What is the inflation rate? What is the dollar to rupee rate so on and so henceforth. Basically sets into motion in the decision and that decision once basically thought in details goes into the action phase and as the action phase goes if you see that as the project is being implemented obviously they would be different type of uncertainty say for example I did not fore see consider the company did not foresee there would be huge turmoil.

In say for example in one XYZ country where the project was being built consider the project was trying to build up a cement factory. Suddenly there is a huge political crisis in that XYZ country whatever their country it is which would mean that there is a huge of amount of uncertainty in the environment. If there is an uncertainty it will affect your decision making process and the overall results would be definitely be affected negatively from the point of view of the project management.
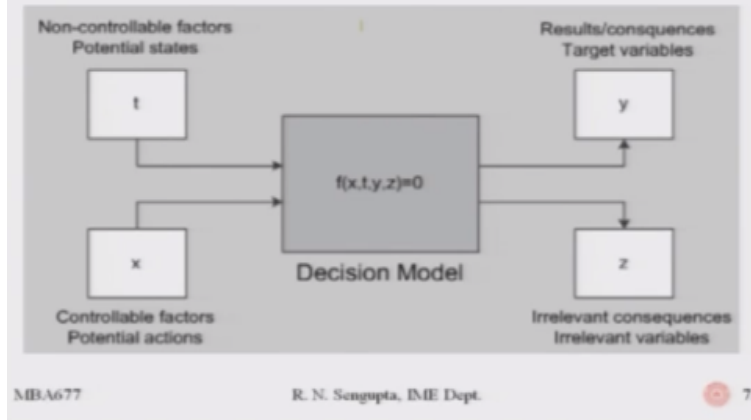
Or consider say for example you want to build up a harbor in the area on Andaman and Nicobar or say for example in the east coast of India suddenly the national calamity can come. So if that natural calamity effects your overall project of building an harbor or say for example the dockyard of the ship then obviously it will have an effect negatively on the total project which you are planning.

It may also happens consider that suddenly the prices of the material based on which you are trying to build up the project consider very simply it is you are trying to build up a very sophisticated transformer and copper prices suddenly rose astronomically or as exponentially. So obviously it will have a negative impact it may also happen that your main engineer who was doing the work suddenly shifts the company and moves to your rival company that can also have a negative impact.

So all these things uncertainties have to be taken into consideration based on which the result final result would basically affect the total project management decision process which is being undertaken in by you and you team.

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Project Management Decision Model

Non-controllable factors
Potential states

t

$f(x,t,y,z)=0$

Decision Model

Controllable factors
Potential actions

x

Results/consequences
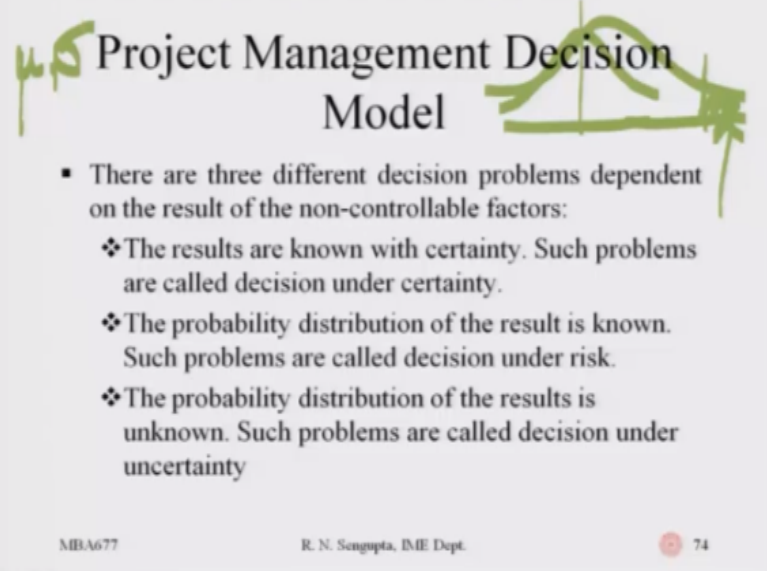Target variables

y

Irrelevant consequences
Irrelevant variables

z

So the decision making process which I have is basically or you would have is basically a function. So this F X T Y Z which I have inside that bracket are different variables. So X can be cost T can be time Y can be say for example information rate Z can be gold to the rupee price gold price and so on and so henceforth. So the non-controllers factors or the potential states which they can happen and here sorry this T is basically a non-controllable factor for time.

For generally you can take T as a time also you have the controllers factors which are a new control. So there is a white noise which is being affected and you have some control on the white noise and some control you do not have on the white noise. So you basically try to differentiate if you can break down into the effect rate into two different independent factors. The end results and the consequences can be target variables can be irrelevant variables.

So consider that you are destroying a petroleum and the price of the kerosene which may be one of the byproducts has crashed. So if it is crashed which means that you cannot sell the petroleum it is basically a loss and you have to basically term it has a irrelevant consequences or irrelevant variables based on which you make your decision. On the other hand consider the price of gel or petroleum gel due to some reason that suddenly some medical discovery was made and it was found all the petroleum gel had a huge amount of of medical benefit for some medicine.

If suddenly that increases then then it would basically have a huge impact on your project even though your main consequences was basically not to manufacture petroleum gel. So these positive and negative impact would basically have and the end result also such that you could basically decide your project management scope of things in the overall sphere where both external and internal factors would be effected either positively or negatively to affect your overall project implementation phase till the result.

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There are three different decision problems depending on the results of the non-controversial factors the results are known with non-certainty. The probability distributions of the results are known and the probability distributions are unknown. So if you consider the first effect the results are known such problems are called decisions under certainty.

So if you have decisions under certainty the concept of risk would not arise which means that all things are known to you know the time you know the resource constraints which are there you know the cost implications. There is no change in the cost implications all the variables which are external and internal to the system and known to you at certainty value or hundred percent probability value and you work accordingly.

In the second thing that if the certain T is concept is not there you will basically consider them to non-deterministic and stochastic now it is non-deterministic stochastic then two point would

come under point number two under the second bullet point. Number one is probabilities distribution are known and they are independent so if they are independent if you remember the first example if will be very simple calculation of the expected value if you want to find out the overall average value for each and every event add them up find out the probabilities find out the overall variance and do your calculations accordingly.

No this adding up of the probabilities if they are independent would be true for any type of distributions. But consider that if the distributions are dependent if they are dependent and if they are normal then trying to basically find out different type of norm normal distribution considering different combinations or normal distributions is simple. Because normal distribution has very fantastic property which I do not want to maintain because this is not part of the course.

People who are interested and checkup the problem with the properties of normal distribution. What if you consider the distributions are not normal then it will mean that they are non-normal then there and if their dependent and then obviously it would it would imply that the concept of correlation would come into picture the concept of co variance would come into the picture, the concept of join multivariate distributions would come into the picture and if you consider the concept of extreme value distribution just I am mentioning that for the interest rate of the leaders.

That extreme value distributions considers the overall risk are at the extremes so if you consider just for the interest of the readers I am just giving a very brief review. It has not mathematics as such in the discussions so if we know the normal distribution let me use continue using this this pen which is a little bit bold consider this is a normal distribution and in the extreme value distribution you are distribution would be like this.
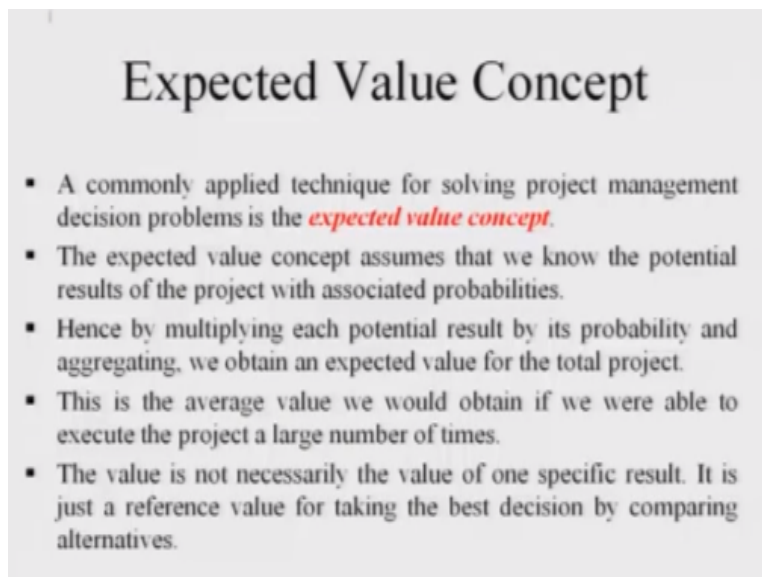
Where the overall effect would be on the extreme so if you are trying to basically combine these two extremes then trying to find out the overall effect on combination of different type of extremes would mean that you cannot use covariance structure as such and try to utilize the concept of say for example popular theory in order to combine the different distributions. The

probability distributions if they are unknown if they are trying to utilize different type of Bayesian concepts.

Bayesian concepts means basically you try to analyze the problem that considering prior distributions of the different parameters are known to you with some certainty value or means certainty value and they you try to combine those prior information in trying to basically predict what would be the parameters. Parameters the means the general variables based on which the distributions has been built so if you consider the normal distributions generally has mu and sigma.

So these are two other parameters for the normal distribution so the probability distribution if they are generally not known then you consider the concept of Bayesian concepts. Utilize the Bayesian concepts to find out the distribution and the combine the concept of Bayesian distribution along with the dependent structure independence structure and then then do your calculations accordingly to find out the overall probability.

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Expected Value Concept

- A commonly applied technique for solving project management decision problems is the *expected value concept*.
- The expected value concept assumes that we know the potential results of the project with associated probabilities.
- Hence by multiplying each potential result by its probability and aggregating, we obtain an expected value for the total project.
- This is the average value we would obtain if we were able to execute the project a large number of times.
- The value is not necessarily the value of one specific result. It is just a reference value for taking the best decision by comparing alternatives.

A commonly applied technique is basically the expected value concept will come to that later on we have been mentioning about mean value there is something you do with the concept of mean value. The expected value concert assumes that we know the potential result of the probability of some associate probability. So if the associate probability is known we have the expected value

we also have the variance because both expected value which is the first moment and the variance which is the second moment would give us a lot of information and implications of how the project is going.

Hence by multiplying each potential result by it is probability if you if you remember the last example where the amount if rupees lost that is two thousand rupees multiplies by the number of days multiplies by the probability if you if you remember the calculation if would exactly mean what the third point means. Hence by multiplying each potential result by probability and aggregating we obtain the expected value of the total project.

Considering dependence and independence structure being there or not there so obviously the calculation may change this is the average value technique we would have only between utilize and through that will obtain if you are able to execute the project a large number of times. So this concept of large number would basically have an implication how we do the concept of simulation in trying to find out that what is the average time a project would be finished I will come to that later on.

The value is not necessary the value of one specific results is just a reference that for taking the best reference and tying to implement it time and again like till an infinite level of simulation you will try to basically get the average as the best probable date by which the overall project would be finished. So with that I will finish the seventh lecture which is the second lecture for the second week and start with the third lecture for the second week in the next class thank you very much.