Project Management for Managers
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Lecture - 20
Risk Management – II

Good morning friends, I welcome you are all in this session. As you are aware in previous session we were discussing about risk management. Let me quickly go through what we did in previous session as I said risk is basically an event which negatively affects your project now being a project manager you should know what are different possible risks which could hamper your project and then you should come up with appropriate risk management plan right. I have also said that you need to plan your project properly because this is one of the points which differentiates between successful projects and un-successful projects.

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I have also talked about risk management risk management is basically an art as well as science why it is an art because there are several stakeholders involved in a project and you need to co ordinate with all the stake holders you need to keep talking with all these stakeholders you need to keep trying to know what are the requirements of different stakeholders. So, if you are in talking terms if you are in if you are coordinating with stakeholders properly then most of the risks you can easily identify right and you can

have a better planning of management of those risks right and it is science also why it is science because to avoid risk you need to apply different risk management tools.

So, those tools are nothing, but scientific tools. So, you need to identify risk you need to analyze risks and you need to respond to those risks this is what we have seen in previous class you need to find out what is the probability of occurrence of an event which would be negatively affecting your project.

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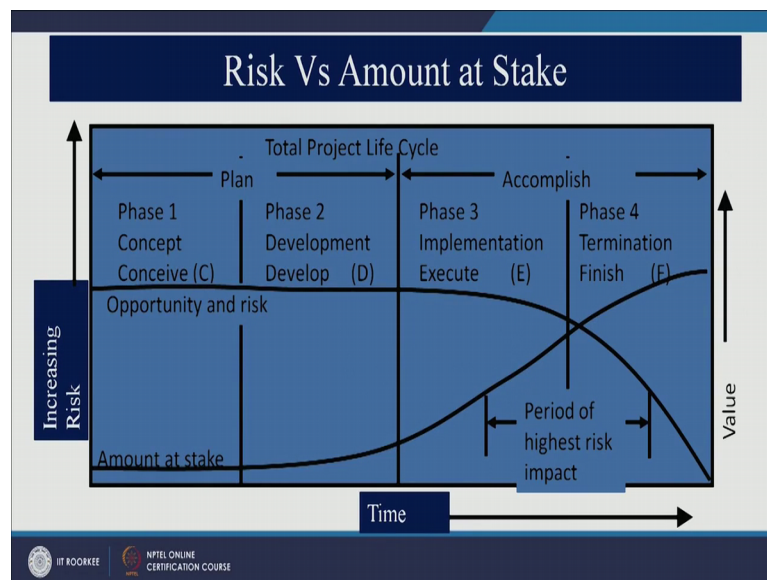
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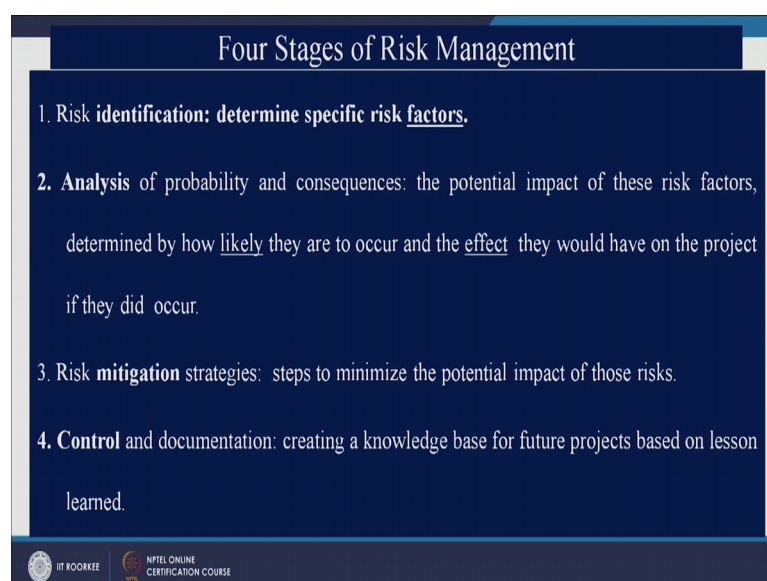
And what would be the impact of that risk on your project. So, project risk is probability of event and consequences of event right this; what we have seen in previous session also. So, there are 4 stages of risk management identify risk analyze probability and consequences risk management strategies and control and documentation these are different types of risks we have already seen.
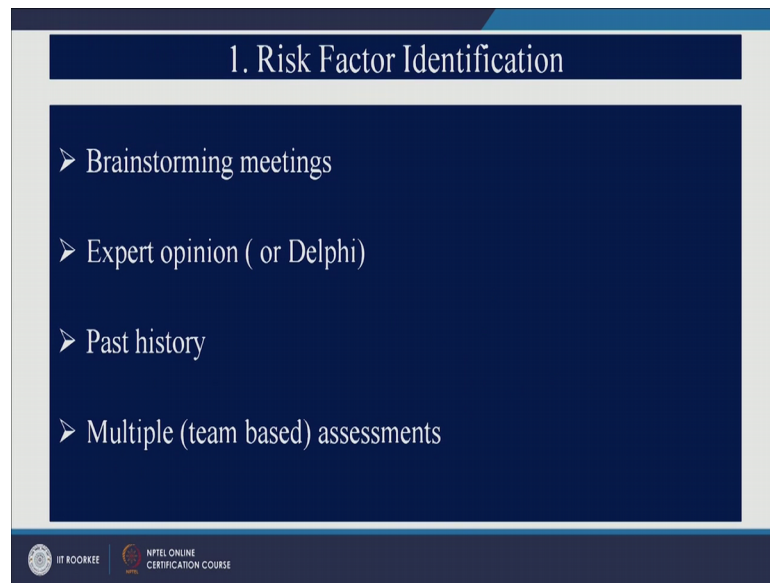
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How to identify risk most important point? So, you can go for brainstorming session or for expert opinion or Delphi method or on the basis of past data also you can identify what are different types of risks as I said you can have several sources for one risk and one source for several risks right.

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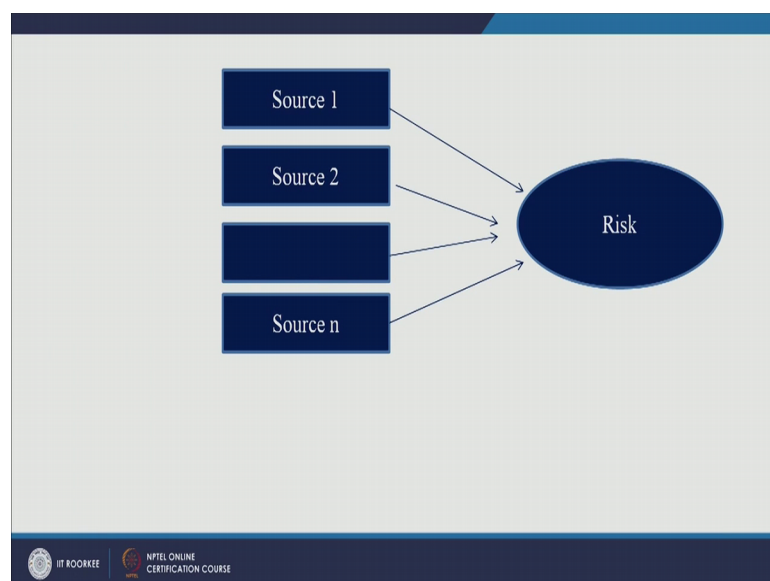
So, you can identify different factors either by reviewing previous documents sensitivity analysis assumption analysis decision tree analysis simulation and diagrammatic techniques right, you should also come up with work breakdown structure similar to work breakdown structure you should come up with risk breakdown structure.

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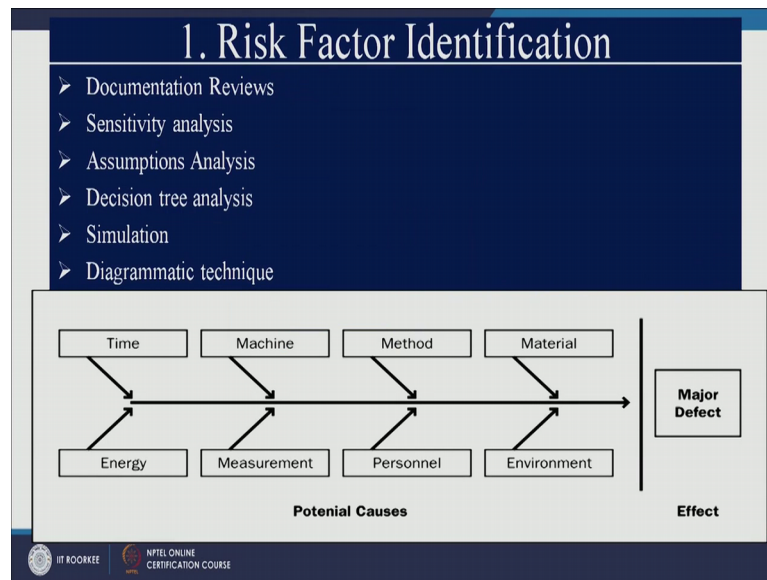
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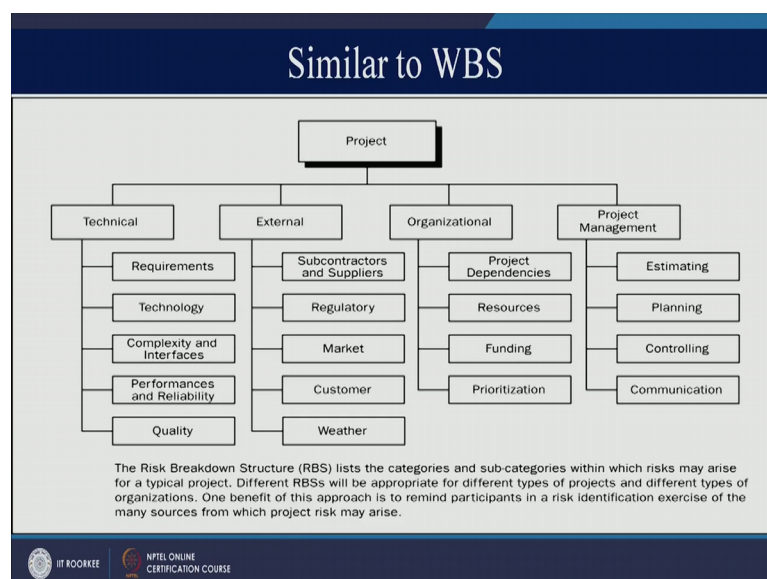
Let us look at this second part in risk management process the first one was risk identification the second is risk management assessment.

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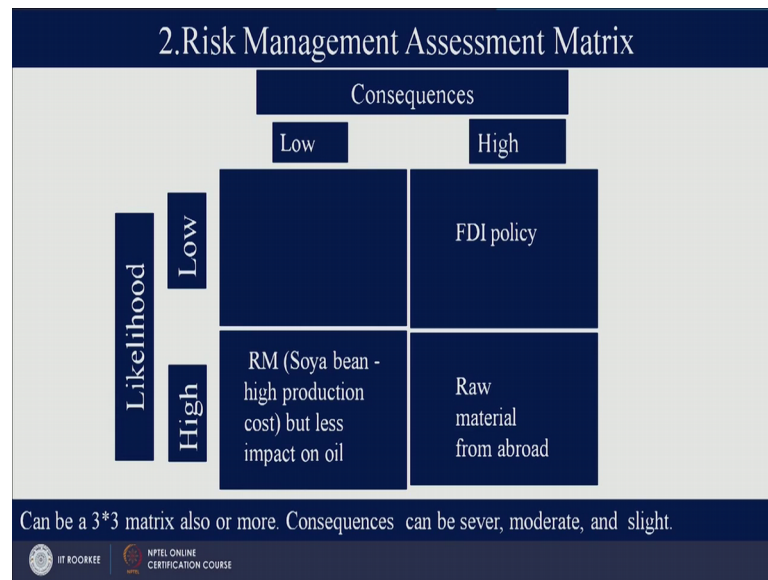
So, how to access risk now risk management can be accessed through a matrix like this is a 2 by 2 matrix where on x axis you have got consequences of risk and on y axis what is the probability of occurrence of risk. So, let us say this quarter you have got low likelihood of risk happening and consequences are also low.

If you look at this quadrant the probability of happening of a particular risk is risk and consequences are also very high right. So, you can have 4 quadrant it is not necessarily that you should have 4 quadrants also only you can have 9 quadrant also you can have a 3 by 3 matrix also, so, rather than having low; low and high you can have a moderate also right. So, in that case you will have a 9; 9 cells right or 9 quadrants right. So, let us take an example of dis-quadrant where probability of risk is very high this one probability of risk is very high and consequences are very high right I will give you an example let us say you want to buy a machine tool from abroad and that machine tool is very expensive. So, to get that machine first of all what you will have to do you will have to let say go for international tendering process or tendering process at international level.

So, you would be inviting beats from several international company's right who would be making those particular types of machines right. So, after analyzing those standards looking at their terms and conditions looking at price looking at delivery time looking at credit period looking at the logistics facilities which those companies may provide, let us

say you are selected one particular foreign company right and in these entire process let us say you have also had a consultant would be you know screening all those tenders which you have received and the consultant has given you a suggestion that you should go for this particular company to get a machine tool right.

Now, once you have ordered the machine and let us say you are supposed to receive it after six months once you place the order once promises given by the company that they would be some supplying at machine to you within six months, but suppose if they do not supply. Now there could be several reasons for non availability of that machine there is a problem at suppliers and there maybe problems at let say airport there may be some clearance problems there may be let say a problem of middlemen because there middleman and middleman there are there would be several agencies in between 2 parties yourself and the supplier of the machine.

For example you will have an insurance company you will have bankers. So, there might be a problem of exchange rate isn't it. So, because of some or the other reasons if you do not get machine in time then consequences would be very high right. So, this is the situation for this particular quadrant right let us look at this particular situation where probability of event occurring is very low, but consequences are very high FDI policy is an example of this as you are aware ours is now an open economy there are several foreign countries who have invested in our country there are several MNCs working in our country and government of India has allowed that to happen right.
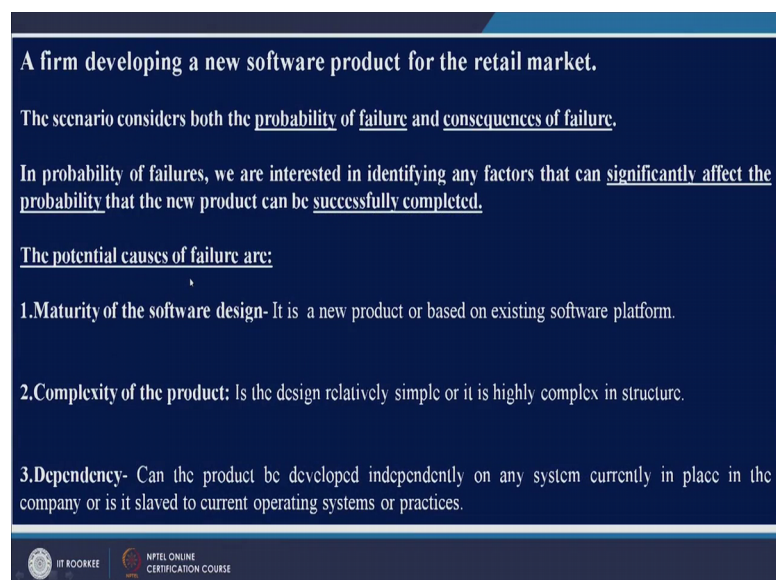
So, and these policies are still continuing in spite of several changes in central government level still these policies are there let us say what is the probability of change in those policies its very low, but suppose if that happens then. In fact, would be very high because what will happened to those MNCs who have invested in India heavily right. So, this is the situation let us look at example of this particular quadrant the probability of occurrence of an event is very low and consequences also very low right you can think of any example for this particular quadrant.

That I will also give you an example let us say the probability that a sign which is let say 20 theta away from me was the probability that ten will fall for that you need to go for past data for example, how many times that send fell down in last, let say 10 years or 5 years or 1 year right. On the basis of that I can find out what would be the probability of

falling on that time. So, that is very low probability and what would be the consequences because there is no one there under that.

So, nothing; there will not be much affect of it right there will not be much impact of that event right; so, low and low right; so, similarly you can think of a situation like this. So, I am not explaining this example you just think yourself and try to come up with an example right. So, this is risk management analysis. So, you need to identify the probability of event if it is high or if it is low then what would be the consequences right let us take another example let us say there is a form which is developing new software for retail market.

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A firm developing a new software product for the retail market.

The scenario considers both the probability of failure and consequences of failure.

In probability of failures, we are interested in identifying any factors that can significantly affect the probability that the new product can be successfully completed.

The potential causes of failure are:

1.Maturity of the software design- It is a new product or based on existing software platform.

2.Complexity of the product: Is the design relatively simple or it is highly complex in structure.

3.Dependency- Can the product be developed independently on any system currently in place in the company or is it slaved to current operating systems or practices.

Now this the software can fail in these conditions there are 3 conditions the first is maturity of the software.

How mature that software is. So, is that software is is a completely new software or based on existing software platform right. So, how sophisticated that software is right. So, loss of a least sophisticated and more sophisticated right you can have 2 extreme ends right complexity of the product now is the design relatively simple or it is highly complex in structure. So, the design of the software is simple or complex right again 2 possibilities 2 extreme possibilities the third one is dependency can be product be developed independently on any system currently in place in the company or it is or it is slave of current operating system right; so, whether the software depends on current

operating system or some other; operating system right. So, these are 3 possibilities of failures of a particular software right which are companies developing right.

Now, since these are different types of failures you need to know probabilities of these failures and then; what are the consequences of this failure right?

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So, let us look at what are the possible consequences. So, under the consequences of failures we are concerns with the effect of those failures right and those effects could be on cost may either increase or may decrease right we do not know right let say if software is matured one right then definitely cost would increase right isn't it.

Let us say if product is complex then cost will increase similarly if let say software is matured then it would be a reliable software right similarly performance would also be very high if software is matured, but cost would also be very high right. So, we have to look at what is the effect of maturity of software on all these 4 right.

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Score	Maturity	Complexity	Dependency
Low (0.1)	Existing software	Simple design	Not limited to existing system or clients. No external or uncontrollable events are likely to impact the project.
Minor (0.3)	Minor redesign	Minor increase in complexity	Schedule or performance depend on an existing system. Effect on cost or schedule is minor.
Moderate (0.5)	Major change	Moderate increase	Moderate risk to schedule or performance due to dependence on existing system, facility, or processes. Effect on cost is moderate.
Significant (0.7)	Technology is available, but complex design	Significant increase	Schedule or performance depend on new system or process. Significant cost or schedule risk.
Major (0.9)	State of art, some research complete	Extremely complex	Schedule and performance depend on new system and process. Very high cost or schedule risk.

Probability of Failure (P_f)

Similarly effect of complexity of product on all these 4 right similarly dependency will also affect these 4 right these 4 right. So, now, you need to come up with a matrix where in you need to you probability of failures right. So, let say as I said maturity can be you know least maturity in most maturity right or so, existing software probability of failure is point one minor design probability of failure 0.3 major changes probability of failure this technology is available, but complex design probability of failure this state of the art some research complete right.

So, sophisticated software right probabilities 0.9 now all these mature when I say existing software its probability is 0.1; all these will affect what cost schedule reliability in performance minor design will affect all those 4 points right similarly so on right. So, what would be the type of matrix you are coming up? So, for one failure this would be affecting cost schedule reliability and performance this would be affecting 4. So, this is 5 into 420 then again 5 into 425 into 4 is 64; 20 right. So, total 60, but rather than going for such a detailed matrix we can have we can prepare a very simple matrix right.

But before preparation of that matrix let us look at consequences of failure let us say as I said cost may increase or cost may come down right.

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So, budget estimate is not exceeds its probability is 0.1 cost estimate exceeds budget by less than 5 percent its probability is 0.3 if I more then 30 percent its probability is 0.7, but cost estimate exceeds budget by more than 50 percent its probability is 0.9 right. So, these are consequences of failures for cost right similarly for you can have for schedule for reliability and for performance right.

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Now, let us take a very simple example right and after that we will find out risk factor. So, there is a; we will be calculating project risk score and on the basis of that we will

decide whether the project is a risk your project or not right. So, you can again divide risks into different categories low risk medium risk and higher risk right. So, let us find out score right. So, first of all identify factors and assess the probability and probability of failure and probability of consequences right; so, its P f and C f right. So, this is for probability and this for C is for consequences right; calculate overall probability and consequences. So, P f is equal to summation of all P is divided by n C f is equal to summation of al C is divided by m and then calculate overall risk factor by just reading these 2 and subtracting it by multiplication of these 2 right. So, this is how you can find out risk factor.

Hope this point is clear right. So, risk factor is probability of failure consequences of failure minus multiplication of probability of failure and consequence of failure its right. So, I have taken a very simple example.

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Probability of Failure (P_f)				
Score	Maturity	Complexity	Dependency	
Low (0.1)	0.10	0.15	0.13	0.38/3 = 0.12
Minor (0.3)	0.30	0.20	0.25	= 0.25
Moderate (0.5)	0.50	0.45	0.40	=0.45
Significant (0.7)	0.72	0.75	0.65	=0.70
Major (0.9)	0.95	0.92	0.90	=.92

Consequence of Failure (C_f)					
Score	Cost	Schedule	Reliability	Performance	
Low (0.1)	0.11	0.18	0.15	0.18	0.15
Minor (0.3)	0.32	0.25	0.25	0.29	0.27
Moderate (0.5)	0.52	0.47	0.44	0.49	0.48
Significant (0.7)	0.75	0.70	0.60	0.72	0.69
Major (0.9)	0.95	0.92	0.90	0.93	0.92

So, for the time being you just forget these values right forget these values and these values also right. So, probability of failure maturity if it is low then let say a problem is 0.1 if its major let say 0.9 right probability of failure for let us say dependency it low 0.13 dependency is very high its 0.9 right.

Similarly, you can assign other probabilities also right similarly consequences of failures what are the different probabilities of consequences of failures. So, for cost if it is low then it is 0.11; 0.95 if it is very high right. So, you can have again these probabilities. In

fact, you can change you can replace this cost with this cost also its a probability of let us say a consequences of failure probability is low and that probability is 0.11 even if you replace it with 0.9 5 then also there will not be any change in your answer; right.

So, after assigning probabilities of failures in this matrix you just take the average of all these 3 values. So, average is 0.12; similarly average for second low 0.2, 0.5, 0.45, 0.72, and 0.92, right. So, these are averages of all these 5 rows and similarly this column is nothing, but average of all these 4; 4 values right first second third and fourth night. So, this column gives you average of these 5 rows right these 5 rows right 1 2 3 4 and 5 right.

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0.10	0.15	0.13	0.38/3 = 0.12
0.30	0.20	0.25	= 0.25
0.50	0.45	0.40	=0.45
0.72	0.75	0.65	=0.70
0.95	0.92	0.90	=.92
			0.48

0.11	0.18	0.15	0.18	0.15
0.32	0.25	0.25	0.29	0.27
0.52	0.47	0.44	0.49	0.48
0.75	0.70	0.60	0.72	0.69
0.95	0.92	0.90	0.93	0.92
				.50

$$RF = P_f + C_f - (P_f)(C_f)$$

$$RF = 0.48+0.50- (0.48*0.50) = 0.74 \text{ (high risk)}$$

Rule of thumb
Low risk RF< 0.30
Medium risk = 0.30 to 0.70
High risk >0.70

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Now, after that once you are done with calculation of average take the average of all these averages. So, 0.12, 0.25, 0.45, 0.70, 0.92 and average is 0.4, right, similarly for consequences 0.15, 0.27, 0.48, 0.69, 0.92 and average is 0.5. So, even if you replace fifth row with first row your average will remain right. So, now, let us calculate risk score right. So, RF is risk factor. So, probability of failure is 0.48 right probability of consequences 0.50 right minus multiplication of these 2.

So, this value is 0.74 and we have initially said that if the risk factor is less than 0.3 will say it is a low risk project if the risk factor is between 0.3 and 0.7 we will say it is a medium risk project if it is more than 0.7 then we will say it is a high risk project; so, as for as this particular project for which I have arbitrarily assigned probability of failures

and consequences this value is 0.74. So, it is a high risk project right. So, in this way you can assign probabilities now who will assign this probabilities this is this is basically important point right who will assign these probabilities. So, you need to again talk to experts; experts will tell you that if maturity is very high then what would be the affect of that high maturity and cost.

So, that probability you will have to talk to experts or group of people you can talk to right after getting probabilities then you can easily calculate risk factor right. So, this is this was the second point right analysis of risk first point was what are what are there are 4 points in risk management process. The first one was identification of risks second we have just seen analysis of risk and let us look at third point which is risk mitigation how to mitigate this.

Now, there is a risk available in front of you what to do now very important point if the risk is minor then accept it right because if risk is minor there will not be much or consequences of it right.

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So, accept it if it is very minor risk if you do not want to accept it then minimize risk right give one example let say Boeing company has got millions of parts and they have got thousands of vendors and if something goes wrong in one of the parts of the Boeing then what would be the risk you can think of right lots of lives lost and lots of money lost right. So, it is the responsibility of Boeing company to minimize these risk and how they

minimize this Boeing sense their engineers their designers their quality inspectors to the plants of different vendors right. So, they are ensuring that vendors provide them right quality materials.

Similarly, their vendors also visit their vendors; right. So, vendors would be visiting their vendors right and so on right. So, this how you can minimize risk in your project the next strategy could be sharing of risk you can share your risk with someone else also right. So, can you tell me any example of sharing of risk there is a risk on your project, but you are sharing it with someone else right. So, I hope that by this time you would have come up with one or 2 examples on sharing of risk.

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3.Risk Mitigation Strategies

- Share - Risk may be allocated proportionately among **multiple** members of the project. European Space Agency and Airbus consortium - (huge capital and technical skills). BOOT is another example.
- Transfer - Insurance. Fixed price contacts (fixed price for the project upfront and if overruns builder will bear).

Let me also give you couple of examples right. So, risk may be allocated proportionality among multiple members of the project.

For example European space agency's as you are aware that in Europe there are several countries and they have got a common space agency through which they are they are launching their satellites. So, if something wrong happens with the satellite then the cost would be borne by participating countries right and it would be indifferent proportional right it is not that the cost would be shared equally right. So, so it is similar to the benefits would also be shared in proportional manner right. So, costs and benefits would be shared in proportional manner right.

Another example is of this boot right it is a new concept it is let us say I want to construct a let us say government want to wants to construct a project from let us I Delhi to Roorkee right. So, they can give contract to a contractor who would build it he will own it he would operate it and then you transfer it to government right. So, this is another example of sharing of risk right. So, risk would be shared by government as well as by contractor right. Now once you are done with sharing of risk the next strategy could be transfer of risk right. So, either you accept it or you minimize it or you share it or you transfer it right.

So, how to transfer a risk insurance; insurance is very good example of transfer of risk; so, if there is a risk on your life you just take life insurance policy now the risk would be with insurance company right. So, this is another example of this is one of the examples of ensure transfer of risk right. I will give you one more example let us say I want to buy a flat in a building right and I have given money to builder and he promised me to deliver flat by let us say let us say within one year's time right if he does not do in one year's time then what who would bear that risk.

Now, there should be an agreement between builder and yourself that if you do not supply flat within stipulated time then 6 months after stipulated time will both of us will be a half of the cost which is going to increase right after 9 months, my risk would be zero and it is it would be entirely your risk right. So, in this way you can have a sharing of the transfer of risk right. So, fix price for every project up front and if over overruns builder will be a right. So, this can be another example of transfer of risk.

So, with this let me stop here we will start the remaining point of risk management in next session.

Thank you very much.