Project Management
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Module No # 07
Lecture No # 34
Key Components of Earned Value Management

A very good morning, good evening or good afternoon to all my dear friends and students and whoever is taking this course. So, this I do repeat, please bear with me this is the thirty fourth class or thirty fourth lecture, each lecture being for half an hour duration of half an hour for the project management one. And I am sure you know my name so I would not repeat it. So as we were discussing in the thirty third lecture the earned value project concept.

And how the curves for the budgetary constraints, budgetary costs or the budgetary resources with respect to the plan one or the actual one, how they can be analyzed and how we can use the different concept of efficiency to find out how your work was going on I did discuss in quite a detail like both talk and talking and trying to give you the analysis because here the concepts of whom you trying to utilize the quantitative tools is less in scope because as you are able to analyze.

And try to utilize the different techniques which you have already learned, the HP, the different types of financial concepts about six to seven of them the yield, the IRRs then the decision tree the expected value so those can be utilized along with this earned value project management concept and holistically they would definitely give you a very good idea and how the different techniques of project management can be utilized.

So continuing with that, so, we will now discuss the earned value under the earned value project management concept.

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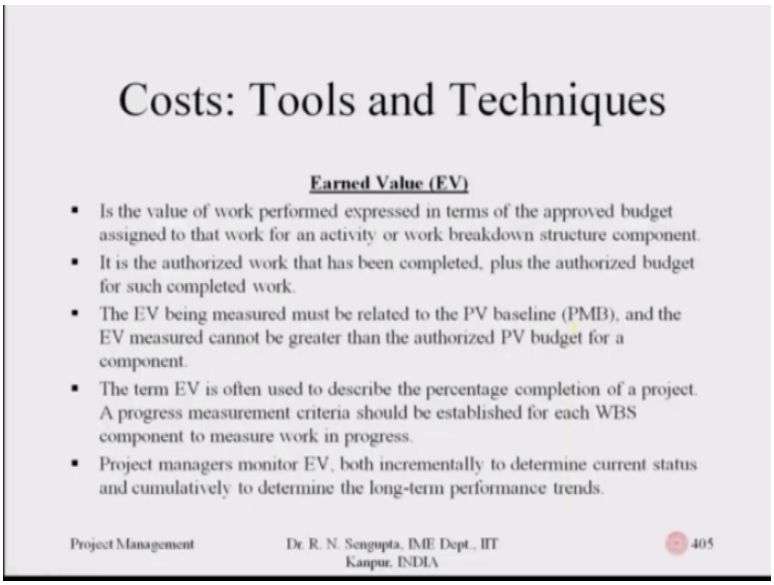

It is the value of the work performed expressed in terms of approved budget assigned to that work for an activity of work breakdown structure component so if we remember the concept of work breakdown structure, what we did mention and what we even though we did not go into detail about that. It is basically trying to break the overall project into small components or activities as that trying to combine the set of activities would give you the project.

But it would be much easier if you are able to analyze the time duration, the expected value, the optimistic time, the pessimistic time, the most likely time, the variances and all these things for those levels of activities and jobs would give you a much better picture. So this earned value is basically the authorized work that has been completed till time certain time plus the authorized budget for such a completion of the work.

So you are trying to basically make a one to one comparison with respect to the time taken to finish some amount of work, other total work or some number of activities with respect to the overall cost for that particular set of activities or till a certain value of the project completion which is there. The earned value being measured must be related to the PV which is the concept which we just discussed in the last slide of the thirty third lecture.

So this is the PMB baseline which we did discuss. So this is the baseline, over and above or below that value that would give you an indication whether you are doing good or doing bad and the value of EM, EV or the concept of EV measured cannot be greater than the authorized value

of PV, such that you know that whatever the amount of money which you have with respect to the budgetary constraints would basically make sense that you are able to analyze the overall concepts for the cost and the time schedules for the project or the set of activities.

Now term EV which is the earned value is often used to describe the percentage completion of the project. Progress measurement criteria should be established for each and every work breakdown structure which you are trying to utilize or component to measure how the work is progressing. So as I mentioned sorry for repeating that time and again you are trying to basically analyze both on the maximum micro level as well as the macro level for each and every unit for the activity.

Which basically accomplishes the overall project. Such that you are able to take a decision whether the that particular activity is actually using more resources, less resources whether you are able to finfish that particular activity before time, after time, so all this things can be considered in a very practical sense. Project management monitor the EV value both incrementally that at each unit, which is basically the marginal rates is important for you.

So why it is important because it helps us to determine the current status and cumulative it also helps us to determine the long term performance strength of the particular projects are that you can take both or short term view as well as the long term view. Based on which you can analyze the project.

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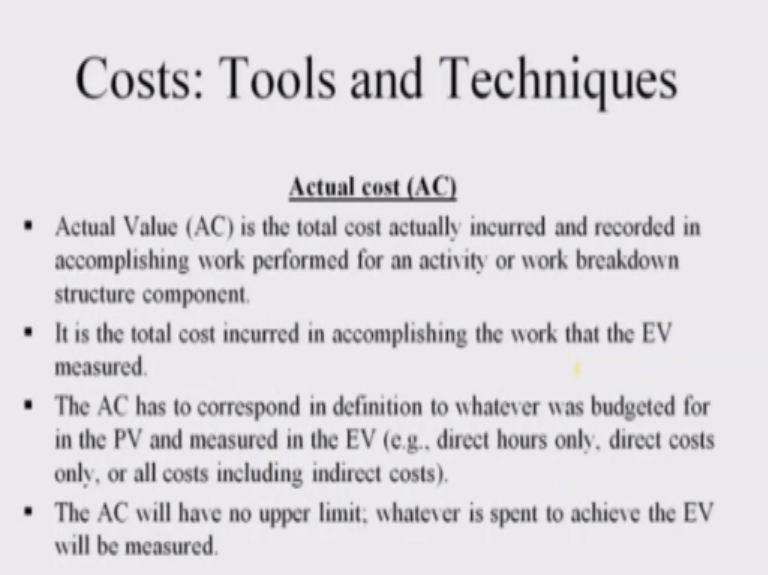

The actual value which is the third bullet point which we will discuss is the total cost actually incurred and recorded in accomplishing work performed for an activity. To work breakdown structure component so what you are trying to do is that you are trying to make a balance with respect to the work performed for an activity or the work break down structure component.

So that you can make a one to one analysis. It is the total cost incurred in accomplishing the work that the earned value has measured so you are trying to basically find out the total cost with respect to the earned value and how what is the earned value.

That means what is the value net worth with respect to the actual cost which you have incurred the actual cost has to be, has to correspond in definition to whether or whatever the budget was and whether the budget for the PV and that measured in the EV concept are matching or there is a dichotomy between that so one is you have a budget and another is the actual cost based on which you will try to analyze whether the actual cost is over the budget or below the budget.

AC will have no upper limit because that is actual spending which you are trying to do on the actual cost which you are trying to incur so whatever it is spent to achieve the earned value will be measured and based on the earned value and the actual cost which you have incurred as I mentioned you will try to make the analysis for the project.

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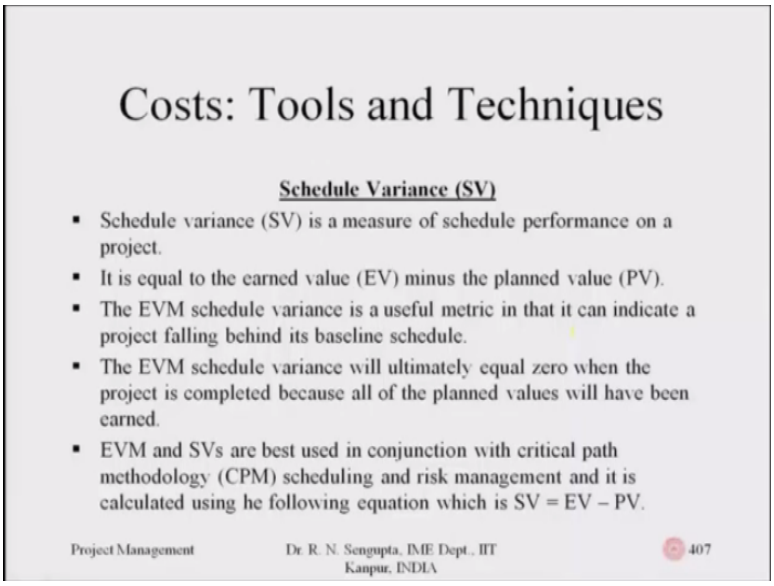

The schedule variance so now the few bullet points which we are going to analyze would basically give you the dispersions. So if you remember we did mention dispersion time and again we did discuss that variance would be considered as the measure of dispersion for the decision tree analysis and the utility and the other simple concept. And if you remember also and I am repeating it for different type of small projects or decision tress or the complex projects.

Whatever you had, we first try to analyze the point of view of the problem from the expected value considering the utility as given in the problem. And if the utility changes you know how to calculate the expected value of the utility and expected value of the decision. And if the expected values were same when then went to into trying to find out the dispersion of the variances and also one thing.

I have mentioned even though it may have been in one of the lectures when we were discussing the returns. I mentioned that if the returns are normal and then we rest issues the utility based on which you are trying to do your calculation are all quadratic in nature or vice versa and in general all the returns which you consider on normal distribution based on the fact that even though if any other normal distribution, excuse me is true.

Still it would be true that you can use, safely use central limit theorem concept and try to convert whatever the distribution is for the activities or for the group of activities into a normal case and try to do your problems accordingly so continuing with that we will analyze this concept of

different concepts of variance from the earned value project management concept. So it is equal to the earned value – the plan value.

So if the earned value is more than the planned value or vice versa you can take a decision whether the work is going on as per the plan or whether these deviations or dispersions. The earned value management concept schedule or he variance which is basically in front of you considering is the SV which is the schedule variance concept is a useful metric in that it can indicate a project falling behind its baseline schedule or whether it is basically is going ahead as for the wave function.

Such that you can take a stock of this situation at any point of time. The EVM schedule variance will ultimately equals zero that means the overall variance should be actually zero once the actual project is worth over. Which means the project is completed, because all the plan values will have been carried out and the work have been finished. So what you are trying to now analyze is three things.

What you want to achieve, whether you have been able to achieve, so if you have been able to achieve with respect to what you and want to achieve at the end of the day, the overall the scheduled variance is zero but having said that there would be other two important concepts conceptually which should be important is that whether the cost to achieve is that more than the budgetary one if it then there is a matter of concern point number two is that if it is less.

Obviously it is not a matter of concern but you have to analyze the problem accordingly. Another thing is that rather going into the resource console concept, and the total concept or the other micro level cost of each and every schedule. You will also try to find out whether the time utilization has been as per the planned concept. So if the time utilization is as per the planned concept then obviously you will be able to say that yes.

Look the budgetary constraints have been met, we have not over shooted our schedule utilization of the resources we have not also over shooted our time utilization as per the norm, hence the project can be deemed proper from the point of view from all the different type of ratios which is

which we are now discussing. But even if the schedule variance is zero, at the end of the project it is mentioned here that once it is complete the schedule variance is zero still we will try to find out if the cost is high time is fine.

Then obviously there is some problem from the cost perspective if the cost as per the norm and the time is high, then also we will try to analyze the problem from the time perspective then if both of them are a problem which is the fourth different issue which can come out then obviously a very hard loop decision has to be taken that see the cost has also increased the time has also increased so we need to find out the whether at all the project was feasible from the point of view based on which it was actually early taken up, earlier taken up.

The EVM and the scheduled variance are the best used in conjunction in the critical path methodology which is the CPM, so even though I have not considered the CPM problem as such, remember the way of how you tackle the CPM problem is exactly as per the concept what which you did for PERT method, but only in the PERT method the initial set of calculations which are there in the PER method would not be there in the critical path method.

Because in the PERT method, we had the non-deterministic time, the variances the optimistic time, the pessimistic time, the most likely time based on which you find out the expected time and proceed accordingly. So as I was continuing the EVM and the SV which is the scheduled variance which are best used in conjunction with the critical path methodology CPM critical path methodology concept and risk management using the difference between the EV and the PV values. Which we already know what they are.

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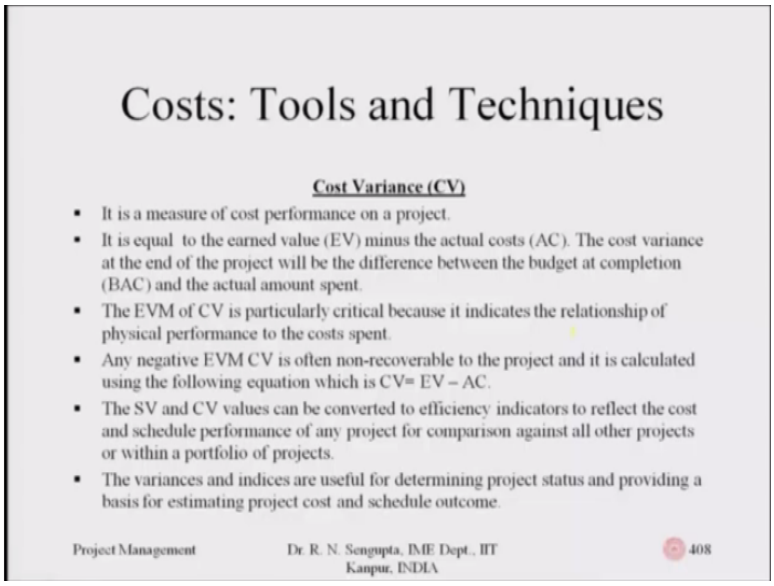

Now come to the cost variance concept it is the measure of the cost performance of a project whether you are exceeding the cost or below the cost it is equal to the earned value – the actual cost so you will try to find out the differences, if the differences are positive or negative you will take a decision accordingly.

Whether the cost variance is high or low or definitely within control so again variance being high or variance being low would have two different concept from the point of view of a person who is wither risky. Risk taker or a risk lover or a risk hater or a neutral person.

But we will always try to analyze the problem that if I exceed the budget or I am below the budget obviously the overall consequences are different to what level or what quantum the consequences are different that would only depend on what type of person I am. But I will definitely try to analyze the problem any person does that on a very qualitative and a logical sense he for him or her in a overshooting your time undershooting our time.

Overshooting the budget under shooting the budget, all these things would have two different consequences. And obviously not of the same quantum, it is equal to the earned value minus actual value cost as I mentioned the cost variance of the end of the project will be difference the budget at completion and the actual amount spent so what was the budget and what was the actual amount spend the cost variance is particularly critical with now I am reading third point.

That the cost variance is particularly critical because it indicated the relationship of physical performance to the cost spent so what I will try to see is that what proportion of the job has been finished was finished what proportion of the project has been finished, what is the number of days it has utilized what is the total number of resource it has utilized and if required will try to basically analyze each and every resource allocation separately such that we can concentrate on any resources which are problematic.

Any negative cost variance is often non-recoverable to the project and it is calculated using the following equation which is the difference between EV and AC. The variances concept which I just discussed now which is the cost variance and SV which I did in the last slide they can be converted into efficiency indicators as I did mention when we started out discussing this different type of ratios there if the cost and the scheduled performance of any project for comparison against all other projects.

So you can use the expected value can we can may be use the variance, these variances and these concepts of expected value from the point of view earned value concept from the project management concept of point of view can also be utilized to compare the projects. So for comparison against all projects or within a portfolio of projects which is in front of you the variances and indices are often useful for determining project status and providing for estimating project costs and scheduled outcome based on which you can take a very practical and holistic decision.

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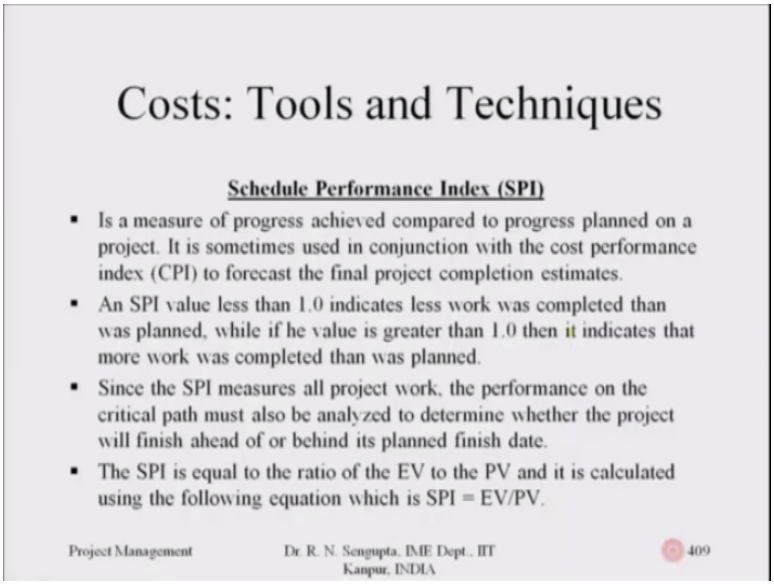

The next point we will discuss about the variance is that the schedule performance index so the word index is a ratio, and ratio is basically some sort of efficiency as I mentioned as we were doing the last session, and as we continued doing this session which is the thirty fourth one. So, SPI, is the measure of progress achieved compared to the progress planned on a project, it is sometimes used in conjunction in the cost performance and index which is the CPI so what is the cost performance index we will come to that.

So, one is the scheduled performance index and one is the cost performance index. Now very simple scheduled performance index and cost performance index will be considered in the point of view of number of days or number schedule and the course perspective. So what you are trying to do, we are trying to analyze both the important matrix is not the matrix of the data on we need to have the matrix is basically the measure we are trying to utilize both from the time as well as the cost perspective.

So an SPI value less than one indicated, less work was completed then it was planned while if the value is greater than one then it indicates, the more work was completed than was planned. Based on which we can take a decision. So doing more work obviously does not mean that we are doing much more than the efficiency, maybe possible some of the works were redundant other or the cost over turn was high or the delay in the project was such that it gives you the negative impact of the overall project.

Since SPI measures all project work the performance on the critical path must also be analyzed to determine whether the project will finish ahead of or behind its planned finished date. So when you are trying to analyze the SPI any over shooting or under shooting from the point of view of cost please bear with me, I am repeating things time again but they have a huge implication when we try to utilize the problems he quantity of techniques and try to put in the quantitative framework.

So, the SPI is equal to the ratio of EV by PV, so it can be the one or it can be more than one, so as I mentioned on that you can take a decision accordingly. So what for one of the project say for example the value is coming out to be point eight and for other in the value it can be point nine, so if all the other constraints other budgetary implications are fixed then obviously it means the value of point eight and point nine would have two different consequences for the overall project which you are trying to tackle.

So this slide basically considered one of the important so called dispersion concepts based on the fact that the efficiency was important to calculate for any project and the discussion which we had in the last two or three minutes was basically the schedule performance index or the SPI. Now I will go to the CPI concept.

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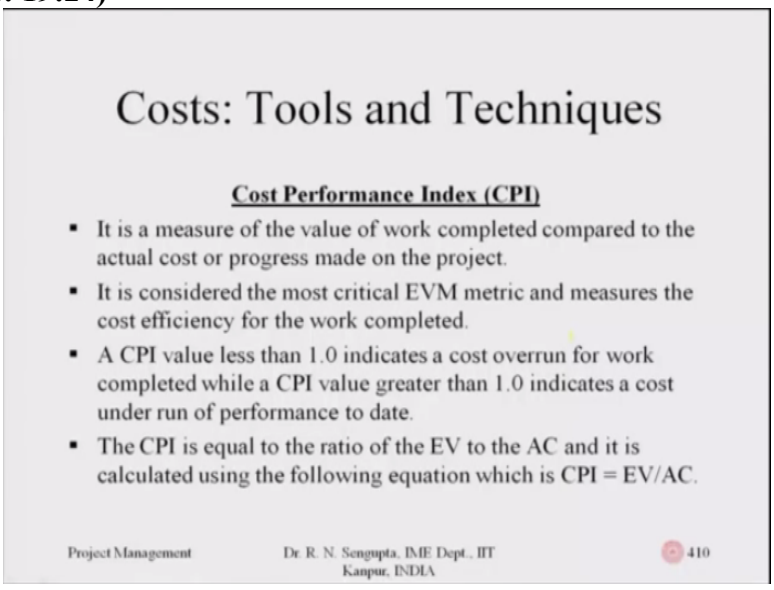

So the cost performance index concept it is basically a measure of the value of the work completed come compared to its actual cost of progress, based on the project or on the probable

project or the set of activities. So you are basically trying to compare the actual cost or the progress made with respect to whatever was planned in a certain sense. It is considered the most critical of the other earned value management concept or project management concept matrix.

Which we had discussed till now and it measures the cost efficiency measuring the work completed because at the end of the day obviously, time scheduling is important from the PERT and CPM concept but what is important is that whether you have been able to utilize the resources to the maximum possible extent and what was the cost of implication for each and every unit used of the resources a CPS.

CPI value less than one indicates cost overrun for work computed while a CPI value greater than one indicates a cost under run of the corresponding to the performance till date. So what we are trying to analyze for all these ratios it can be you try to analyze these ratios or this efficiencies or this expected value at the end of the project but, best would be if you try to analyze different type of activities at a certain point of time.

And then take a decision whether you need to fasten up a particular activity or try to slow down the particular activity, where you need to basically remove some resources from one activity to the other. Or try to hire the resources from the vendor or try to basically put more resources into the activity or to basically plan your overall project as per the norm. The CPI is equal to the ratio of the EV to the AC and it is calculated using the ratio which is EV divided by AC.

So whenever you have a project, what you actually want to do is that you try to analyze the problems, from the point of view of the ratios these ratios which we discussed even though they have an implication from the financial point of view but they also consider the cost as well as the time perspective. So that the cost perspective or the volume of work completion perspective would be basically different ways of trying to handle the same issue at the different point of view or different perspectives.

Such that you get a much better view or your overall work for the overall project is going on. So in this chat even though it is a repetition to what we did as we were we did the different type of

so called earned value project management concept in bullet points in one of the slides in the last session. But still I will basically I request my students to have some patience and go through the discussion once again.

Because if you remember I did mention as we were doing the thirty third, thirty fourth lecture and also as we completed the thirty second lecture that the new implication of the utilization of the different type of quantitative techniques along with the qualitative techniques would give you a much better hold on project management as a subject.

So now in the slide that we discussed where the chart was given we had time along in the x-axis, it is also time along the x-axis which is fine in that earlier chat of the table the percentage volume completion was given along the y-axis.

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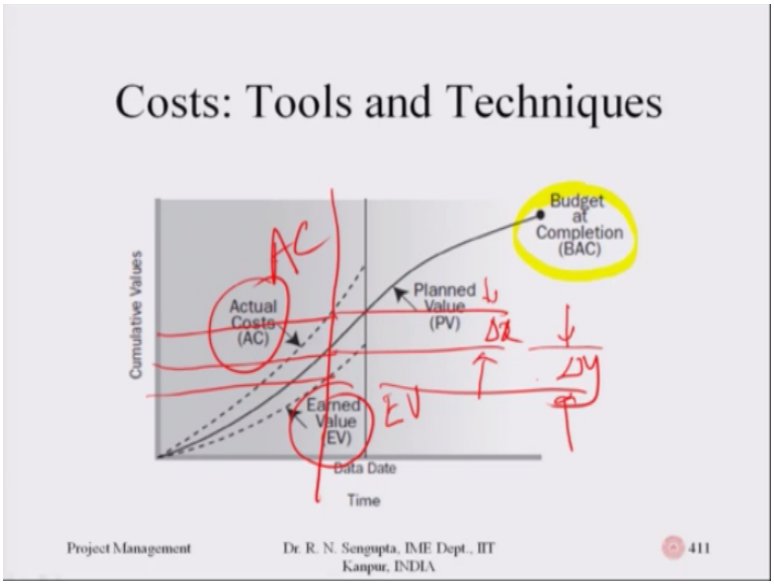

Here we are considering the cumulative value, so what you analyze for the problem, where there is cumulative value whether there is basically marginal rates where these total time taken or the incremental time taken up to each and every, see for example three or four days completion of the job those would basically give you different picture of trying to analyze the frame same problem from different view point.

But the overall implication whether it is positive or negative would basically come out from different perspective but is basically trying to be certain or make yourself certain to the highest level that the decision you are going to take in order to basically channelize some resources from one activity to the other or trying to basically utilize the resources of the vendor or trying to reduce the utilization of the resources for the particular activity would make sense.

If you are trying to analyze the problem from different point of view. So what you have is the bullet line which is the plan value which is the PV value, and here at the end the dot which you have is the budget accomplishment that is when you finish the overall of work and the other two values which you have and again ty to highlight that using so one is the earned value which is EV one is the actual cost which is AC.

Now what you actually do is that at any point of time let me analyze or try to give you quality field at any point of time you, try to find out that, what are the values of actual cost. What is the value of the plan cost of the project and what is the earned value of the project. So what you do is that you find out this differences this can be for the activity, can be for a whole project also so consider this is delta x and this is delta Y, use these values of delta C and delta Y to find out the ratios.

And once the ratios are find out it will be able to at least use the expected value concept or the dispersion concepts, the concepts means the different bullet points which I have mentioned, in such a way it gives you a better picture of how the project is going on. Now before from wrapping up this session which is the thirty fourth session I will try to give you some feel that how the project can be terminated what are the important points one should remember.

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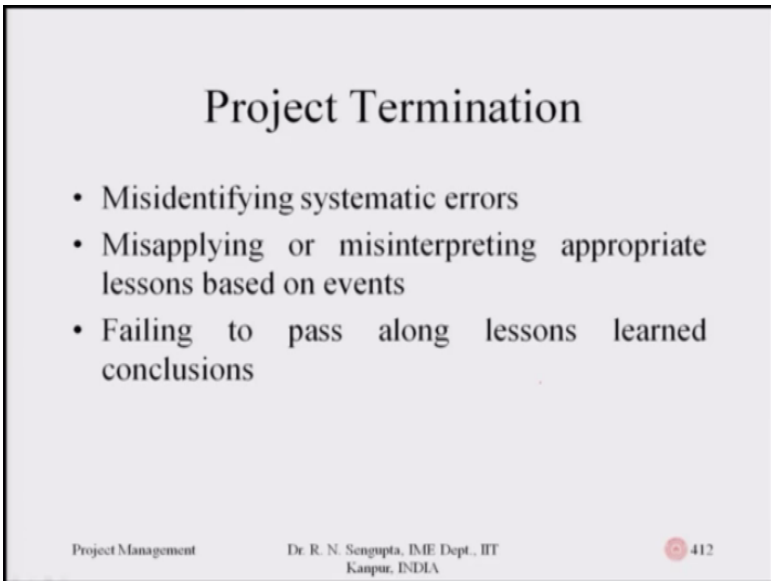

So for the projector mission you the project can be terminated obviously it mean that you have completed the project but they can be other implications also one can be misidentifying systematic errors so they were some errors in trying to finish the project or the project was going out of hand or overall social implication of the project or overall budgetary constraints were we not met or whether the cost of the implications is very high or technology change has been very high such that you need to basically terminate the project.

Whether or immediately or say for example three months down the line or once the fifty percentage of the project is over, so that would depend how things are going on it can be misapplying or misinterpreting appropriate lessons based on events. So we were trying to basically analyze the problem say for example from project one and trying to utilize the concept of project one into project two.

So it may be possible that I am trying to come up with some consider this, some sort of herbal tea in south India, south of India. But if you analyze the problem from the actual realistic point of view it may be possible that herbal tea, tea as such is not liked in south India, because people prefer more coffee there. So obviously you would have or **or** trying to analyze the problem from the point of view of such a project would basically mean the actual assumption based on which I am trying to analyze or trying to implement the project may be actually wrong.

It may be failing to pass along lessons learned conclusion learned from other projects into this project would definitely mean that I have been able to misjudge that and trying to find utilize the concept the consequences of the marketing concepts or the actual implementation concept is actually very low such that it may not be actually possible for me to implement that. so I will give you a simple example actual one that along the concept of the government of India.

Many of the buses, low-lying buses, AC buses were implemented in many parts of India but somehow the overall cost implication of these or the utilization of the passengers in utilizing those high ended a transport system never picked up so even if the government did to analyze from a very a social from the social perspective, from the point of view of trying to give the maximum benefit to the customer was almost the highest form the government point of view.

But many of the buses did not apply so, if I consider that as a project you could mean the actual implementation may have been very good of trying to buy the best bus is trying to run them using the best possible resources would work very high or very good but the end of the day but the actual implication of the user of the customers was almost zero. Hence those overall projects failed.

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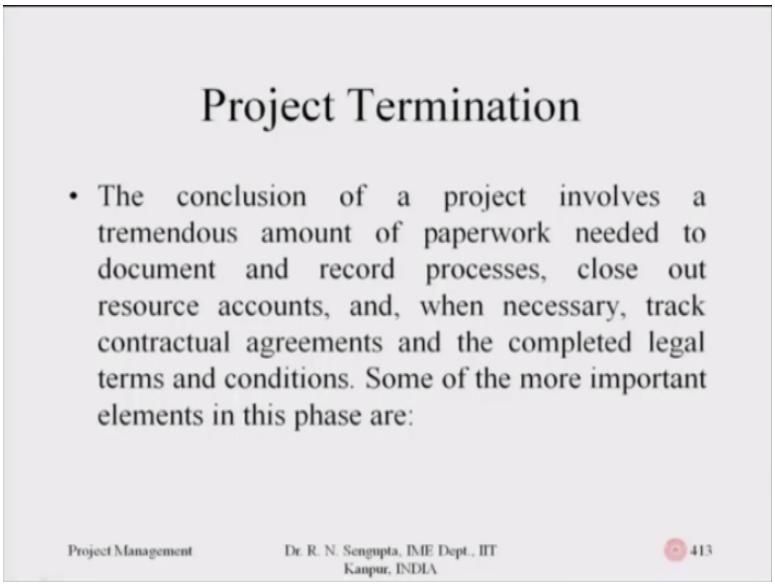

Project termination of the conclusion of project involves a tremendous amount of paperwork needed to document and record processes and how it is going to end, you basically close out

resource accounts try to basically have a look at the financial structure try to see that how the resources have been neutralized, to distribute the amount of money at different ends, when necessary track the track that contractual agreement take actions against it whether any legal or non-legal.

And the complete legal terms and conditions should be done in such a way that there is no such legal or financial issues involved. Some of the important elements in this phase should be considered in such a way that they give you the actual picture that how the project should be finished so, with this I will end the thirty fourth lecture and in the thirty fifth lecture half of that I will try to wrap up the concept of how you close the project and then start with few.

If I did mention about that how the CPM problems can be done, but I will try to analyze a proper in a very simplistic sense and then in the thirty if I again under thirty fifth, thirty sixth, thirty eighth, thirty ninth and the fortieth lecture I will give all my candidates all the students a good field about what is GERT, Q-GERT and try to solve problems accordingly for that. Thank you very much for your attention and have a nice day.