Project Planning & Control

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Lecture – 50

Lesson – 02

Basic Earned Value Definitions and Terminology, Summary

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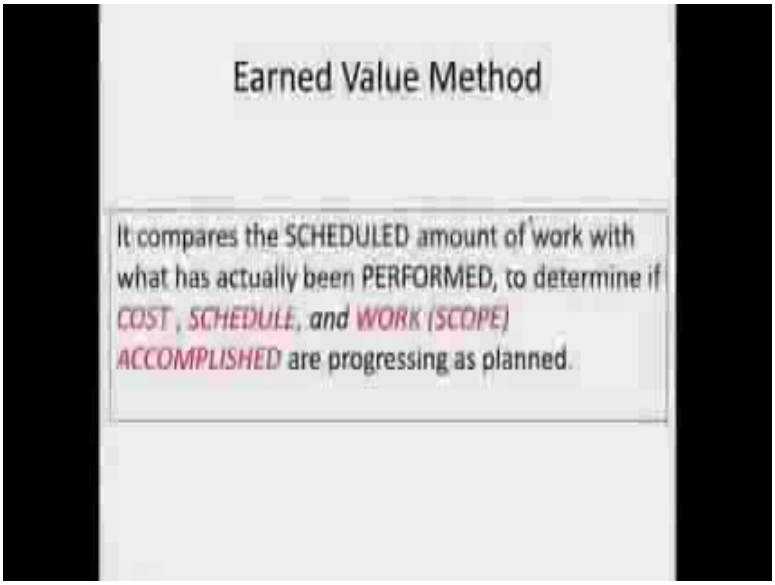

Now, moving forward, if we look at Earned Value Method, it is really quite comprehensive, quite popular and very powerful, because if we are able to monitor based on the amount of work, which has actually being performed. It is not based on, money spent or man hours spent or anything, which is more subjective, it is what is actually done and it is able to integrate the cost and schedule and the work scope.

So, this is the key part why earned value management, because this say it is cost, time and work scope integration is brought into a metric, which can give you an idea of what or how the project is performed.

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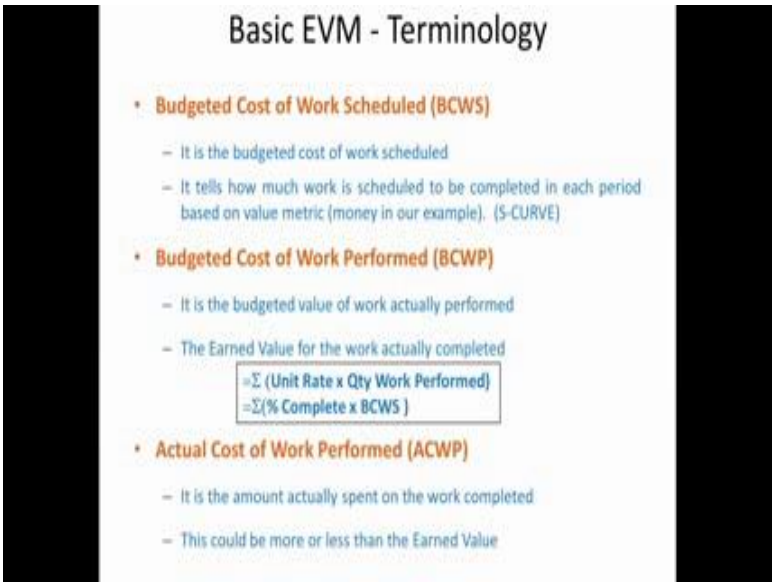

So, if we go into, just review the terminology, we can look at the budgeted cost of work scheduled, we have discussed this I am just reviewing it because it is important to have a slightly formal coverage of these from a definition and a formula perspective. Basically, we know it tells the budgeted cost, it is how much work is scheduled to be completed in each period based on value metric, money in our example and this is the S curve.

Now, budgeted cost of work performed, this is the earned value and we can obtain this by getting unit rate into the quantity of work performed, this is how we did the calculation. But, remember, but you will realize that I can also do this by percentage complete into budgeted cost of work scheduled will also give me the earned value of the project at that of date. The actual cost of work performed, we can do this by getting the value from the accounts and actually, what is maintained in terms of actual cash spent.

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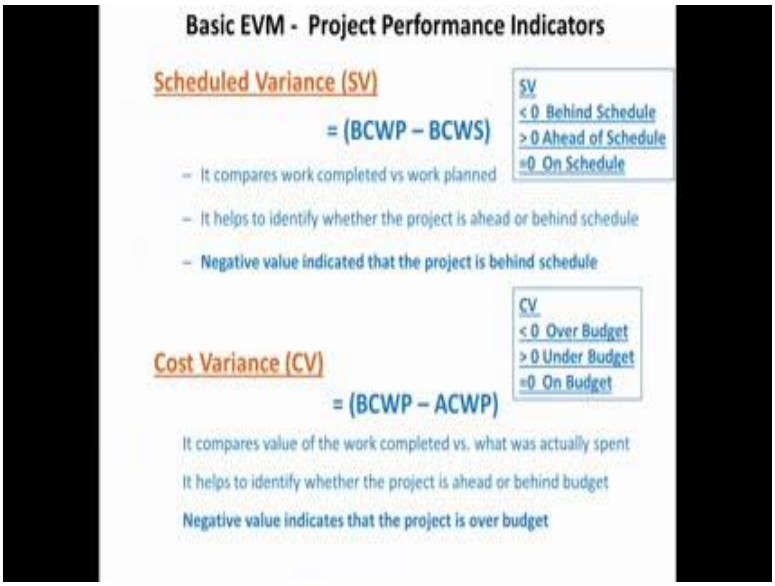

Now, based on these two we get the schedule and cost variance. So, these are the project performance indicators, I can do BCWP minus BCWS to get my schedule variance and as you can see here, it basically if the schedule variance value is less than 0, it is behind schedule; more than 0 ahead of schedule, if it is equal to 0 the project is on schedule. So, this becomes an indicator for variance of the project, similarly, my cost variance is budgeted cost of work performance minus the actual cost of work performance.

So, we had seen how you have, what is the value you got for the, of work you actually did for the money you spent. So, this is what gives you the cost variance, again less than 0 it is over budget, greater than 0 it is under budget, equal to 0 it is on budget.

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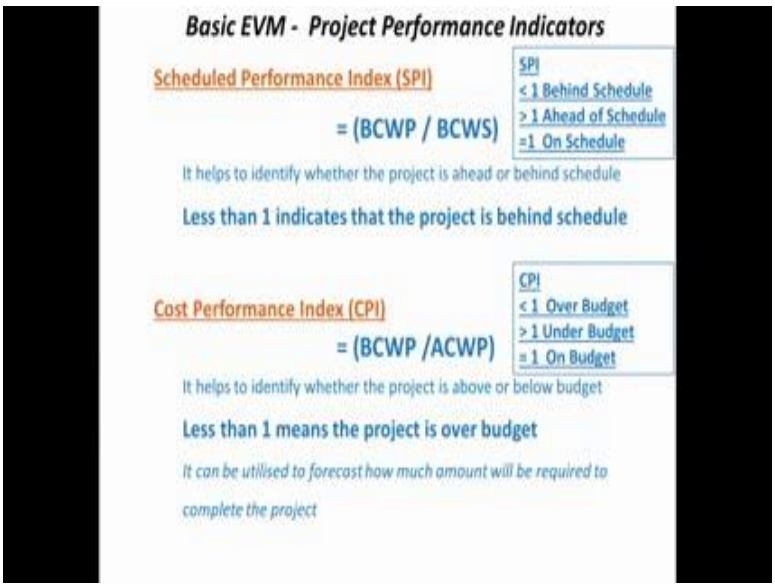

Now, and another way of looking at the performance is what we called SPI, Schedule Performance Index or the Cost Performance Index. So, here it is a ratio, we had dealt with this ratio initially, we looked at in intuitively, for the earth work example we remember we got values of 0.4. We dealt with it intuitively, but we could see that this ratio if it is less than 1, it is behind schedule, greater than 1 ahead of schedule and equal to 1, the project is on schedule.

So, when management looks at it, they will ask you for the SPI, they will ask you for CPI and then, say based on that they can judge, what where the project is at that stage of the monitoring phase. Similarly, CPI you have similar, you have a ratio and the similar range for CPI. Now, one more critical parameter that is used in basic earned value is forecast, I should be able to use my performance measures to be able to forecast, where am I going to finish.

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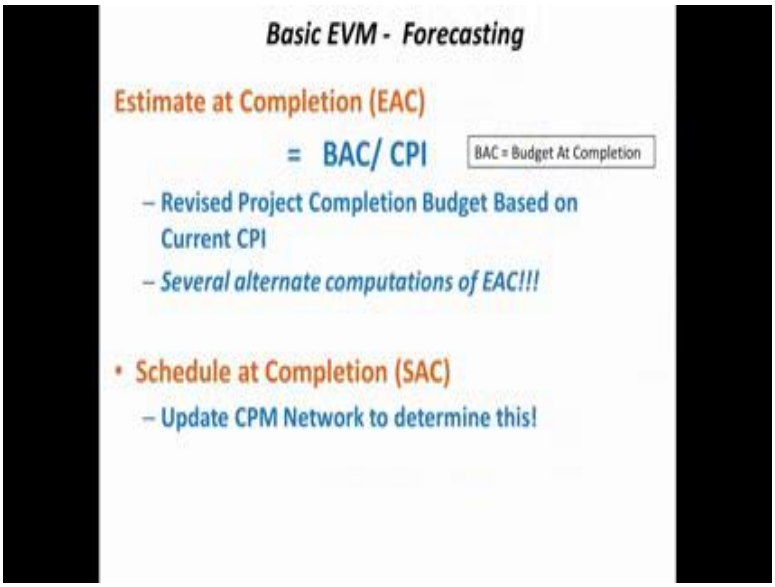

So, your CPI gives me my cost performance index, I take my budget at completion; BAC divide by CPI and I get my revised project completion budget. Now, this is just one of the equations or one of the formulations for estimated completion, but please realize there are references, which give there are several alternative computations for this based on the assumptions made. So, here we are extrapolating based on current CPI, but certainly, we know in a project the things can change.

So, might be the current cost performance is not going be to what is going to be in the future, in which case the estimated completion will, it is a dynamic aspect which will

keep changing. This is just one basic way of computing it and most people recommend, if you want to complete schedule at completion, go back to the network, update the network and based on the network, do schedule at completion, an estimate of schedule at completion.

And although the earned value terminology gives you an equivalent equation for schedule at completion, it is recommended that we go back to the CPM network and update the network to be able to find the schedule at completion.

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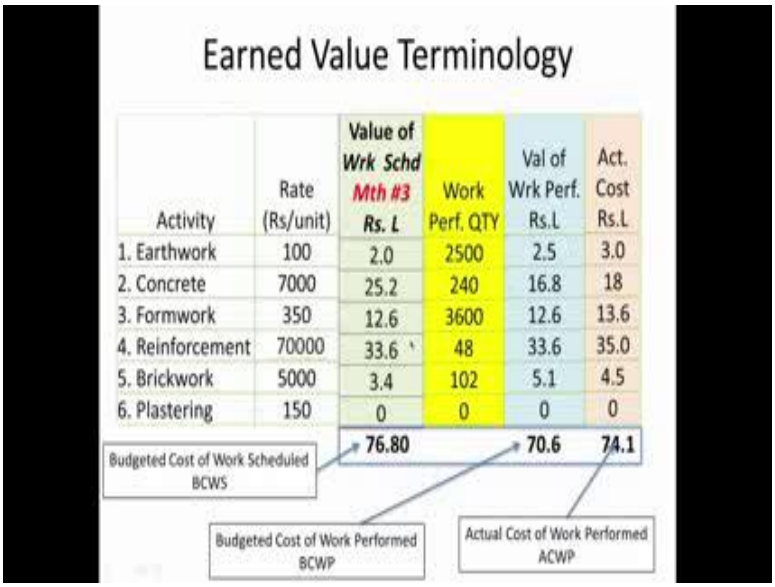

Now, just going back to our example here ((Refer Time: 05:19)), so we looked at now that we have reviewed the terminology, we can see the budgeted cost of work perform, we have looked at the budgeted cost of work scheduled, actual cost of work performed, we looked at our schedule performance, cost performance and in both cases we said that we should have been at 76.8, but we are only at 70.6 as for as schedule goes.

So, we have behind schedule and although we, I mean, although we spent 74.1 we only got 70.6 worth of work, so we are above budget. Now, if we look one thing is when we go to the work package level, we can also do a comparison at the work package level and see what are the packages which are affecting, so this gave us the project snapshot. So, if I go to the work package level, you can see that at earth work we had scheduled only 2, but 2.5 that means my earthwork is doing better than what was planned or schedule, whereas, in my concreting, I can see that 25.2 was what was scheduled, I am only at 16.8 I am way behind schedule as far as concreting goes.

As far as a formwork or reinforcement: both of these, I am on what I had originally planned to do. You can see 12.6, 12.6, 33.6 is as planned and as far as brickwork also I am ahead. So, while I am ahead on brickwork, earthwork and I am doing as planned on formwork and reinforcement, I am really behind on my concreting. So, this allows me to actually pinpoint that concreting packages what is causing me to fall behind schedule.

And in this case, we have no values of plastering, because plastering not yet started. As we get further into the update cycle on this project you can see from the bar chart, that plastering will start at a later stage and as we keep updating on each of those phases, certainly plastering and other values will start coming in. We can do a similar comparison with the value of work performed versus actual cost and see, where our variances are occurring.

And you will find in this particular case, the brickwork we have actually done, got more value, than what we spent, but in almost all days, other cases we have actually a spent marginally more than the value of work done. So, again we might want to look at and other package level and analysis why this is happening and take control actions for this. So, we can see that earned value like we have discussed earlier gives us and insight into the project both are the project level and at the work package level.

And we can go into the work package into more details, into the work package and work breakdown structure might be we will able to get it down to the activity level and which case I do not use to earned value I can use my direct monitoring approach of quantity versus total quantity and productivity and things like this. So, successfully to able to..to monitor a project requires coordination of all this level, at the work face level at the site office, at the planning office, at the management.

So, you I hope you have a feel of how earned value gives more the higher and the package level issues while the productivity monitoring and details issue we covered in the last section give you more of the execution and the planning to the execution level.

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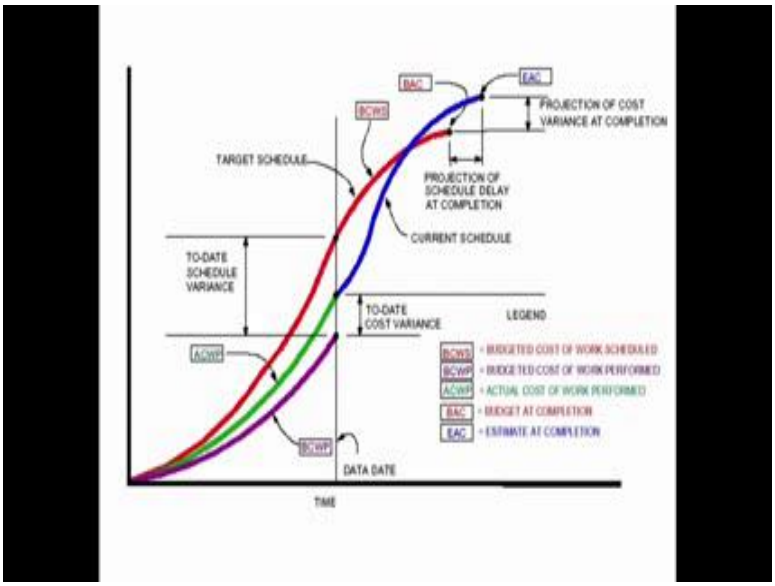

Now, again, so here we have, all of the terminology we discussed in a more comprehensive graph. So, again here we have, green is the actual cost of work performed that is green and the red graph is the budgeted cost of work scheduled, budgeted cost of work scheduled. This is as per plan and the green actual cost of the work performed is the money that we spent, the purple budgeted cost work of work performed is the earned value, this is the budgeted cost of the work performed and this is the data the monitoring time we have taken and this monitoring time we got the earned value ACWP.

And we have already had BCWS and we were able to calculated variance and when we forecast from this, we look at how a basic way of estimated completion and the budget completion here you can see is what is originally budgeted and we look at how estimated completion can be obtained and based on this you can actually calculate the variance of the total project cost at completions.

Almost all the terminology we have discussed you shown in this figure and , we can look at, so here the have the variance, the schedule variance, the cost variance and based on these two, we have the schedule performance index or the cost performance index. So, this slide in a way summarizes a lot of worth all the parameters earned value and what they mean in a graphical sense and how they kind of used and applied to be able to monitor a project.

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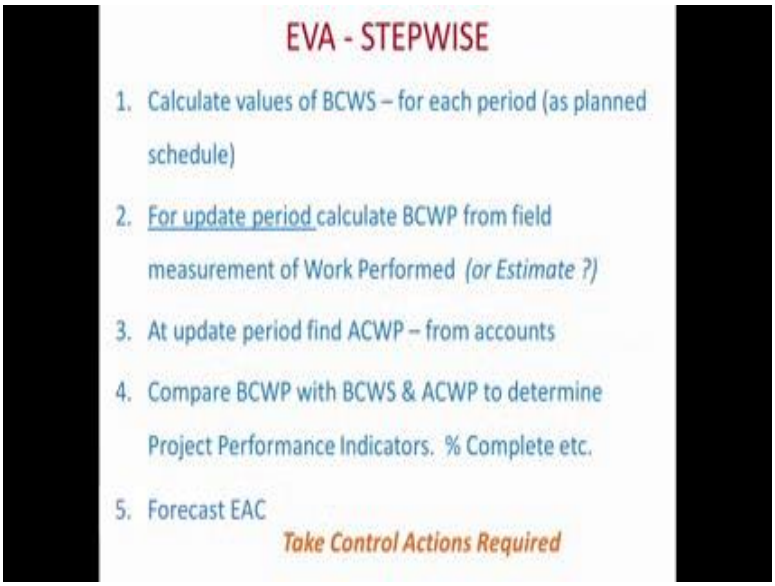

Now, sometimes when we, we would like to look at earned value in a step-wise way, so I hope the concepts on which it is the basic is clear, now we would always like to make it kind of a procedure. So, if you going to look at the step wise fraction, the first thing to do is to calculate the budgeted cost of work scheduled for each period. So, remember from a bar chart, we are able to take a month wise, we were able to all the cost the planned cost at each month and we were able to plot the S curve as well as the monthly expenditure, which is the budgeted cost of work scheduled.

Then, for each updated period, we actually calculate budgeted cost of work performed and we calculate budgeted cost of work perform by taking field measurement of work performed and multiplying by the unit rate for that measurement; that would be the ideal way to do it. But, in cases where that cannot be done it may be through and an estimate of percentage complete and we look at some of these from the lecture last time.

So, ultimately, either I can get a percentage complete a by an estimate or percentage complete by actually measuring the work performance dividing by the total work at the activity level, this is at the activity level. Then, at that same update period, I can find the actual cost of work performed based on my accounts and these then give my way basic parameters for my earned value analysis.

So, I can compare my budgeted cost of work performed, budgeted cost of work scheduled and the actual cost of work performed to determine the project performance indicators and the percentage complete of the project. Now, then we can also do this

forecasting for estimated completion and based on these parameters, I can take control actions as required. And like we just saw, this did not the be done only at the project level ,we can come down to drill down work package level or at a further detail level where there are multiple activities to be able to apply the on value concept to be able to monitor and take control action required at a different level of the project.

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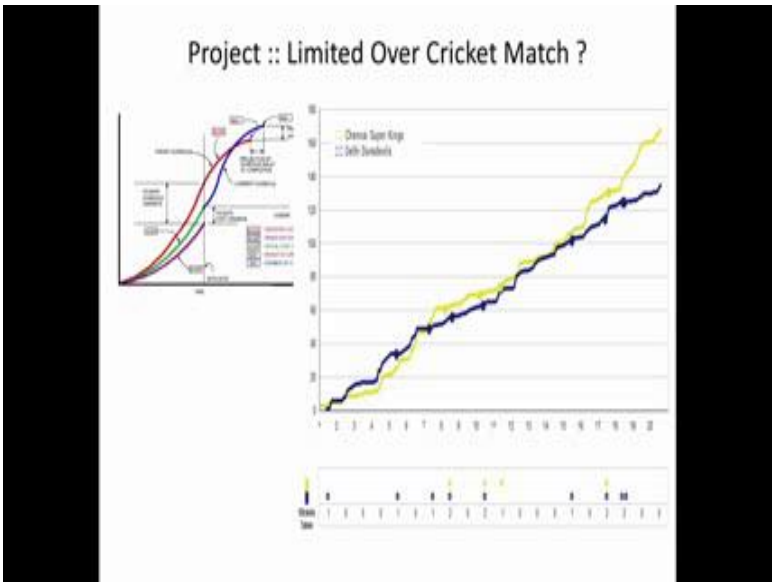

Now, I would like to end kind of showing are enough to make you think about this; when I look at earned value and I look at all of the S curve and the BCWP and ACWP and all of this I am always reminded of a limited over game and we can see the run rate, the asking rate, the catch-up rate, the wickets taken, so I mean I leave it to the course participant to think about this is and see , is there and correlation we have between how we do a run chase, given an asking rate is given, might be the budgeted cost of work schedule is what the first team has a given in the second team is actually doing the execution. So, if you have analogies on this, it will be interesting to hear about it.

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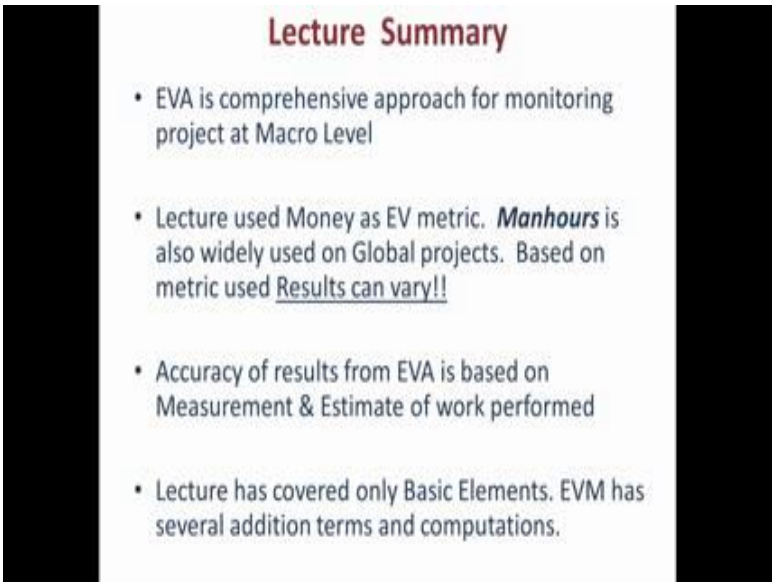

Now, to summarized what we have cover; basically earned value approach comprehensive approach for monitoring project at the macro level. I think through this, through concept cover this I hope you get the feel of how you can really go to the project level being the calculate percentage complete schedule performance and cost performance. And that is really the main, USP of the earned value approach. And it is using doing this based on the actual work done, that is the score. It is not based on money spent that is like that level.

In this lecture we used money as a metric for earned value, we used money and the earned value unit is.. the earned value is money unit. Now, in many places man hours is used, the reason man hours is used is because man-hours tend to be the major component of cost in many global projects. If you control man hours ,you control the project and you control the money that is spent on the project.

So, by controlling man hours, people find in many places that you're not only controlling money, but you're controlling also schedule better with the man hour metric, than money metric. So, in many global project man-hour is the base for earned value metric, but in most project in India you saw using money because we always kept more enough from ..the early years we have kept track money more than man hours because a labour considered to be cheap and might not pay by man hours etc.

But, please realize that both can be done and it is really I mean today with increasing costs in labour etc., man-hours become important; man-hours is becoming more

important; I would say it is already important and we should also be able to do base on man hour metric. Now, one of the interesting aspects is if I measure progress based on money or metric money or man hour metric I can get different results. So, this is interesting; I do not have the time to be able to illustrate that, but might be those of you who are interested to explore this further.

So, I could get the percent complete on the project with say a 40 percent based on money and we know 60 percent based on man hours. So, this is one of the subjective elements and the good planning team should have a judgment on what is really the appropriate metric for their kind of work. Now, also we know while EVA is a good comprehensive technique, the accuracy of the result based on the measurement of a work performed; if I do not get a measurement of work performed correctly, obviously, the project parameters will not indicate things.

And we discussed in the last lecture, how sometimes this measurement is not as objective as we would like it to be; there are subjective elements and there can be estimates, there can be variation and we should also factor this into when we take the values is based on earned value; that the level at which are measurement should be accurate. Now one thing is happening this front is that more and more automated measurement taking place; people we do not have fill form, we can actually go to the site with a.. with a smartphone or a tablet, enter values in it, which is then uploaded to the server and we know there is less chance for errors. Or even more advanced techniques, we have image processing or other techniques which actually capture your progress as you do, and automatically updates; these are more research area. But, they are getting there; we expect that some of these values are more accurate when such technology used and finally, in this earned value is very, very broad area there it is a lot of terminology.

If you go to some other site, especially with the US government, these earned value management there are.. there are manual which just run to 100 pages which just talk about the terminology and the calculation based on earned value. In this lecture we only covered very basic elements; just to give introduction given a earned value for you understand that the concept exists. And as a professional you might have to use these concepts in a leader stage; I think we have laid the foundation for these concepts and , you should be able to use, then , work out basic examples and get comfortable with the terminology of this stage. So, I look forward to question and discussion on this topic.