

Project Management for Managers
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Lecture - 52
Introduction to Project Cost Management

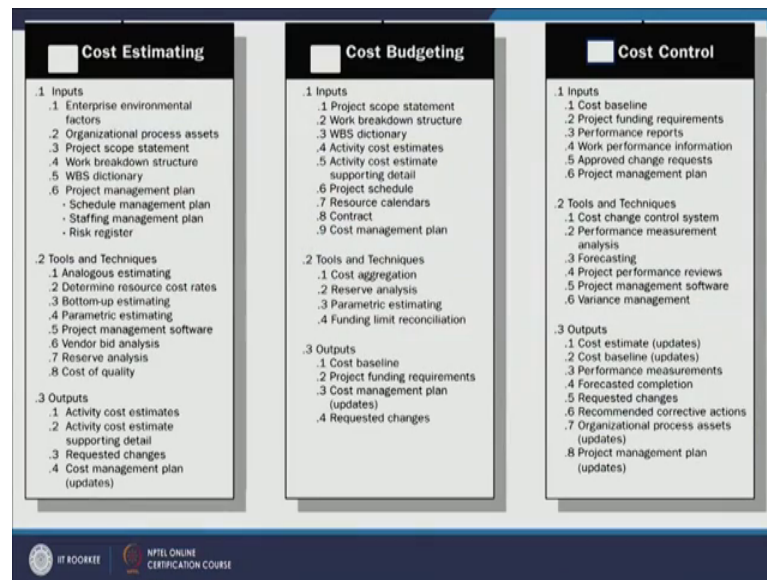
Hello friends, I welcome you all in this section. As you are aware in previous section we were discussing about time and cost relationship. And we have seen that there is a relationship between direct cost and duration of the project. The moment we reduce duration of the project the direct cost increases and indirect cost decreases right. And we have also seen the crashing of the networks. Crashing is quite an important topic. And in crashing we have seen basically 2 methods; one was normal method in which we reduce the duration of one particular critical activity along critical path to reduce the duration of the project. And in free float method which is quite an efficient method; we have seen how to reduce duration of the project.

So, let us say move on to next important knowledge area of project management and that knowledge area is cost management. As I said there are 10 areas if you look at the importance of these areas then almost all are all are important. Let us say project stakeholder's management, another very important area. Because you need to talk to several stake holders of the project, then you would risk analysis right: risk management another very important area.

Now, let us move on to cost management which is equally important, I would not say that this is the most important, but equally important. Again not equally important, but you can say that it is you know amongst first 5 areas right. So, let us get started about cost management, why this area is important? Because when whenever you go for a project, you need to complete it within time. The project should perform its intended function, and it should be within budget.

So, when I talk about budget and cost they are related right. So, that is why cost management is an important area. Even if you are completing project within time it is performing its given function or expected function, but if it is not within cost then it would not be a successful project. So, that is why cost is important area right.

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So, let us get started, in cost management you have got 3 important points, cost estimation cost budgeting and cost control. In fact, there is something called ITTO in project management. ITTO means input tools and techniques and output. So, every area has got certain inputs, certain tools and techniques and certain outputs right. So, if you look at cost management it has got 3 basic processes, cost estimation cost budgeting and cost control. If you look at cost estimation then you need to estimate cost of the project a prior, before you know executing project quiet and important and you know very risky area. How to estimate cost of the project? Because many times you do not know what will happen in future because future is uncertain.

So, you need to look at what might go wrong in project. So, you need to locate some cost for those events which might affect your project negatively right. So, cost estimation is an important area. In this particular slide if you see there are inputs for cost estimation there are tools and techniques. So, you have got tools and techniques for cost estimation, cost budgeting and cost control. So, we will be focusing more on tools and techniques right. Not much on inputs and outputs.

So, let us get started about cost estimation right. How to estimate cost? So, for cost estimation you have to a certain inputs right. Then only you can estimate and there are certain tools and techniques just look at you got analogous estimation, you have got determine resource cost rate bottom of estimation parametric estimation project

management software you got vendor bid analysis reserve analysis cost of quality. So, these are important tools and techniques which would be focusing on cost estimation.

So, once you are done with all these tools and techniques, at the end of the day you will get estimate of the activity cost estimation of the activity, which would be further input to cost budgeting. Just see if you look at this activity cost estimate right. This is one of the inputs in cost budgeting. And then you have got budgeting tools and techniques like cost aggregation reserve analysis parametric estimation, funding limit reconciliation right. Then you have got cost budget at the end of the day it is called cost baseline, we will see how to find out cost baseline.

Then cost baseline means input to cost control. And there are certain tools and techniques just see from here 1 2 3 4 5 and 6. So, these are tools and techniques. So, we will we will look at tools and techniques of all these 3 right. Cost estimation, cost budgeting and cost control right. I say is it cost management is an important area. Because you need to know a priori what would be the cost of different resources which you are going to use in your project. Initially when you plan or initially when you estimate cost of an activity, you most of the times do not consider uncertain days which might occur in future. You most of the times do not you know you take optimistic situation are more often normal situation, but you should think of pessimistic situations also right.

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Project Cost Management is primarily concerned with the cost of the resources needed to complete schedule activities

Different stakeholders will measure project costs in different ways and at different times. (Purchase decision, placing order, arrived,)

Cost estimates are generally expressed in **units of currency** (dollars, euro, yen, etc.) to facilitate comparisons both within and across projects.



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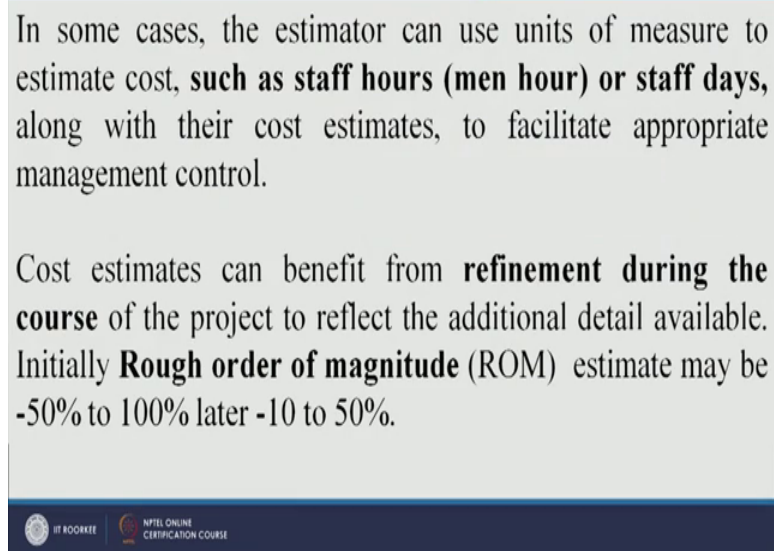


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So, cost management is primarily concerned with the cost of the resources needed right. And you have got several resources right. There are n number of resources right, but basically 5 you can say main machine material money and method right. So, in a in a in a project you will have different stakeholders and all these stakeholders measure cost differently, for example, let us say your purchasing a raw material right. So, while you are in search of let us say vendor selection, you will have certain cost of an item right. After sometime when you are done with all those wondering you know tendering process, then you place an order to one specific vendor at that time cost would be different, isn't it? And when you receive material it is possible that the cost would be different that time. In fact, especially if you are getting material from abroad right.

So, there are several you know factors play important role in costing of raw material or costing of an activity right. Generally we express cost of the project in difference currency right. Either in terms of dollars or rupee or yen whatever is the currency right. But it should be comparable and it should be same across the projects right.

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In some cases, the estimator can use units of measure to estimate cost, **such as staff hours (men hour) or staff days**, along with their cost estimates, to facilitate appropriate management control.

Cost estimates can benefit from **refinement during the course** of the project to reflect the additional detail available. Initially **Rough order of magnitude (ROM)** estimate may be -50% to 100% later -10 to 50%.

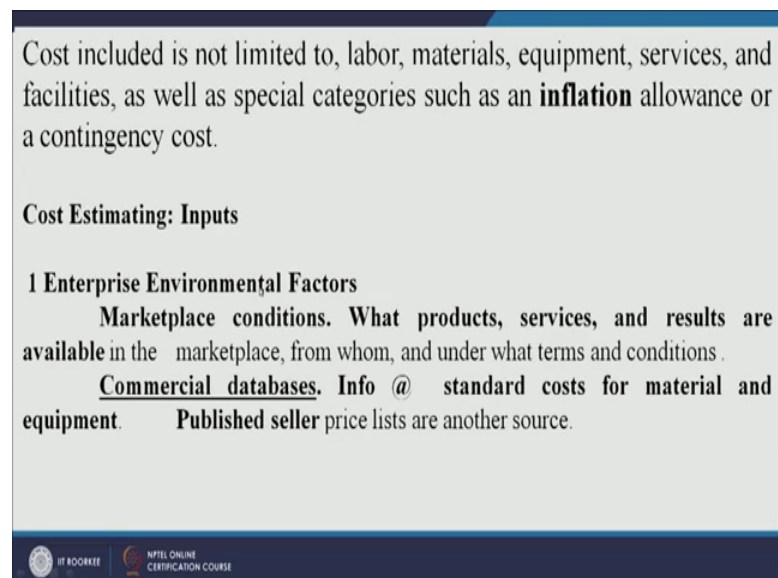
In some cases the estimator can use unit is to measure estimate cost such as staff hours. So, rather than saying that the cost of this project is 1000 crore or 2000 crore we just say that the cost of this project is these many man hour right. You just convert all the you know cost in terms of man hour or staff days. That these project will take 1000 staff days, isn't it? So, you can have this unit also whenever you estimate cost of a project, as

I said future is or uncertain. So, you have to initially you make several assumptions sometimes assumptions are unrealistic, and you plan according to those unrealistic assumptions.

So, when you estimate cost initially what you do? You just have a rough estimation of the cost. You do not just say this estimation of the activity; you will have rough order estimation. It is called rough order magnitude of cost right. So, let us say if you are estimating cost of one activity let us say 100 rupees per day right. So, initially you will say it will vary from 50 to 150. So, you are keeping a range right. And after some time you will try to reduce that range, you will say after sometime 75 to 125 right.

So, you should keep on reducing this range to arrive at final estimation of the cost of the activity right. And cost includes several resources as I said, mainly you can say it is labour cost material cost and a overheads right. And you should also look at inflation while calculating cost right. Of course, inflation plays an important role, and there are some other things which also you should take care of like contentious expenditures right. Some unplanned expenditures; so you should have some budget for those unplanned expenditure right.

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Cost included is not limited to, labor, materials, equipment, services, and facilities, as well as special categories such as an **inflation** allowance or a contingency cost.

Cost Estimating: Inputs

1 Enterprise Environmental Factors

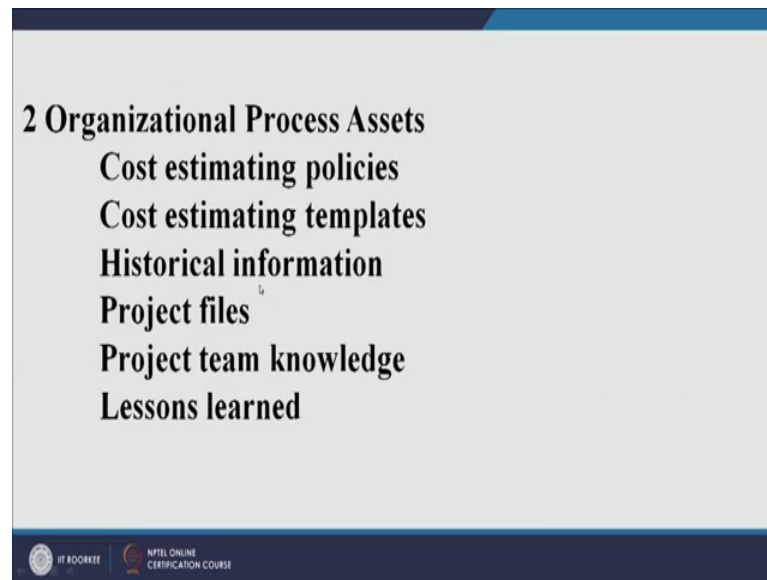
Marketplace conditions. What products, services, and results are available in the marketplace, from whom, and under what terms and conditions.

Commercial databases. Info @ standard costs for material and equipment. Published seller price lists are another source.

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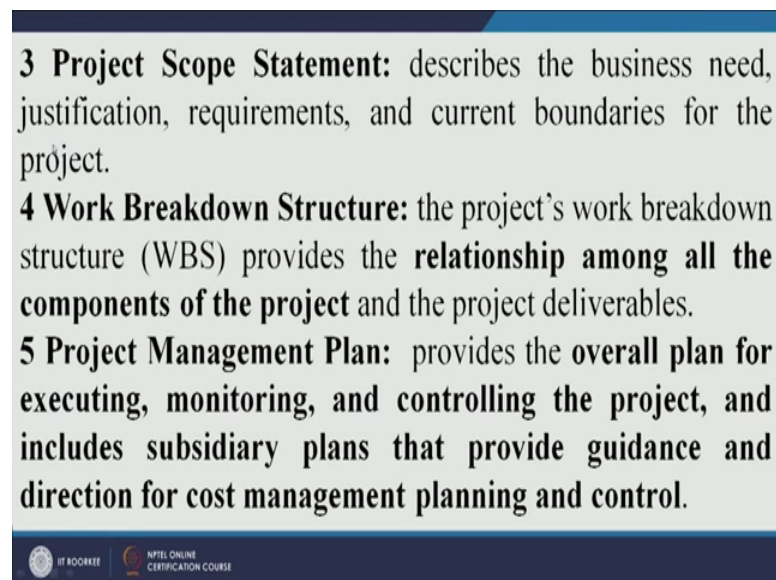
So, as I said cost input use cost estimation has got several inputs right. So, we will not going to details of those inputs, you just look at this there is something called enterprise and environmental factor you got organizational process assets.

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So, these are different point in point number 2, and then you got project scope management we will look at this point carefully.

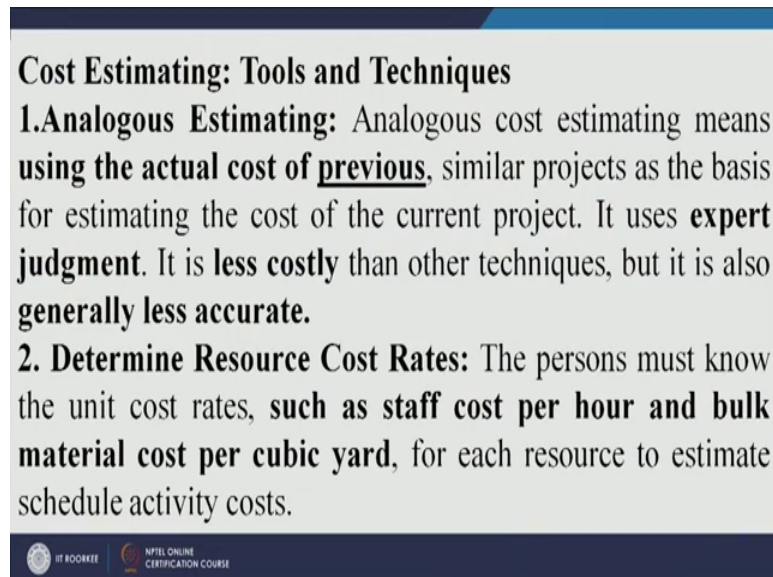
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So, initially as I said whenever you are going for a project with your client you should have a scope very much clearly defined. It should be very clearly known to each both the parties, what are the terms and condition, because the moment your client ask for something more you will be incurring more cost, right more time.

So, that is scope is to be defined very clearly. Then you have got break work break down is structure project management plan. Now let us look at cost estimation tools and techniques right.

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Cost Estimating: Tools and Techniques

1. Analogous Estimating: Analogous cost estimating means **using the actual cost of previous**, similar projects as the basis for estimating the cost of the current project. It uses **expert judgment**. It is **less costly** than other techniques, but it is also **generally less accurate**.

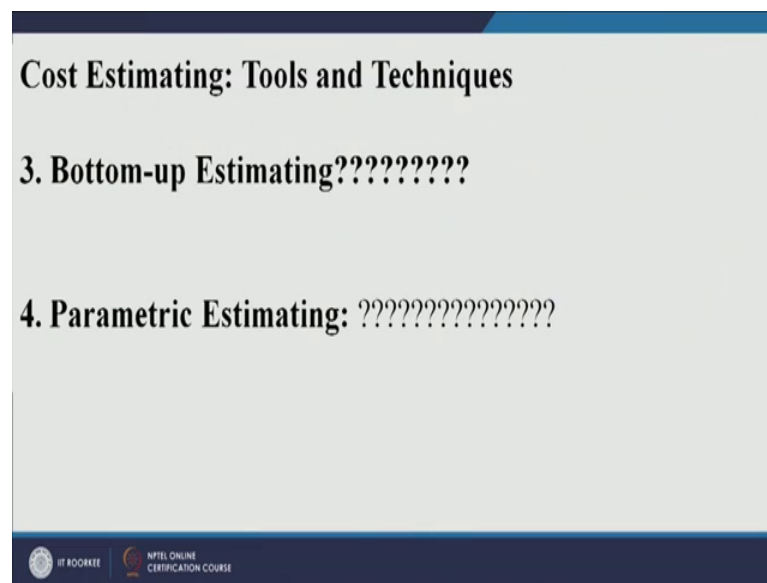
2. Determine Resource Cost Rates: The persons must know the unit cost rates, **such as staff cost per hour and bulk material cost per cubic yard**, for each resource to estimate schedule activity costs.

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So, what are difference tools and techniques, how to estimate costs of the project are, let us first talk about cost of the activity right. So, there is something called analogues estimation it is, it is very simple. On the basis of experience you can know how much cost this particular activity will we will take right; so this very simple analogous estimation. So, you are talking to experts those who are those who have been working in that area right.

So, talk to experts the plus point of this method is it is a less expensive, but does not give most of the times right answer right. Then determine resource cost right. Because your involved in a project you know to some extend that what is the material cost, or what is the labour cost are what is the labour cost per hour per day or per month, isn't it?

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Cost Estimating: Tools and Techniques

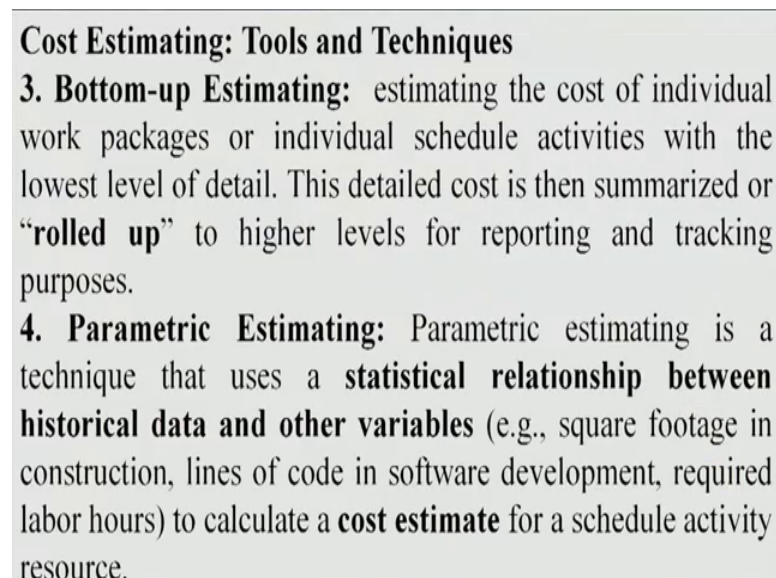
3. Bottom-up Estimating ????????

4. Parametric Estimating: ???????????????

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So, from the resource cost rates you can estimate cost of the activity right. There is something called bottom of estimation and parametric estimation, just think about these 2 types of tools and techniques, and try to answer what is bottom of estimation, bottom of estimation. So, let us look at what is bottom of estimation. In a project you have got 100s of activities. So, first of all you should find out what would be the cost each of those activities, and just some up all of them are is called rolling up rolled up all the cost.

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Cost Estimating: Tools and Techniques

3. Bottom-up Estimating: estimating the cost of individual work packages or individual schedule activities with the lowest level of detail. This detailed cost is then summarized or “**rolled up**” to higher levels for reporting and tracking purposes.

4. Parametric Estimating: Parametric estimating is a technique that uses a **statistical relationship between historical data and other variables** (e.g., square footage in construction, lines of code in software development, required labor hours) to calculate a **cost estimate** for a schedule activity resource.

So, at the end of the day you will get one particular figure right. So, this is bottom up approach, it is sometimes you may have top down approach also right. So, the top management will decide that all these all the activities of the project will have these many cost right. So, it depends on organization to organization it depends on project to project right, whether you should go for bottom up or top down approach right. Then you got parametric estimation, there are several statistical techniques available which will help you in finding out what would what would be the cost of an activity. So, regression is widely used.

So, let us say if you want to know what is the cost of the project, let us say you are coming up with a with a high storey building in a 10 in a 10,000 square feet plot. So, since you know what was the cost of the 5 storey building 10 years ago in a 10 in a 10,000 square feet plot you know what was the cost, 5 years ago what was the cost, 2 years ago. So, you have got data right. So, you have got cost data and you have got time data right. So, you have got time series available. You can use simple linear regression right. It is not necessarily that you should you should simple linear regression, you should see the pattern of past data right. If it is linear than go for linear otherwise you should go for some non-linear regression techniques also right. So, there are something called parametric estimation. So, there are some statistical techniques available for estimating cost of the activity right.

There are several softwares available these days which we will tell you what would be the cost of the activity.

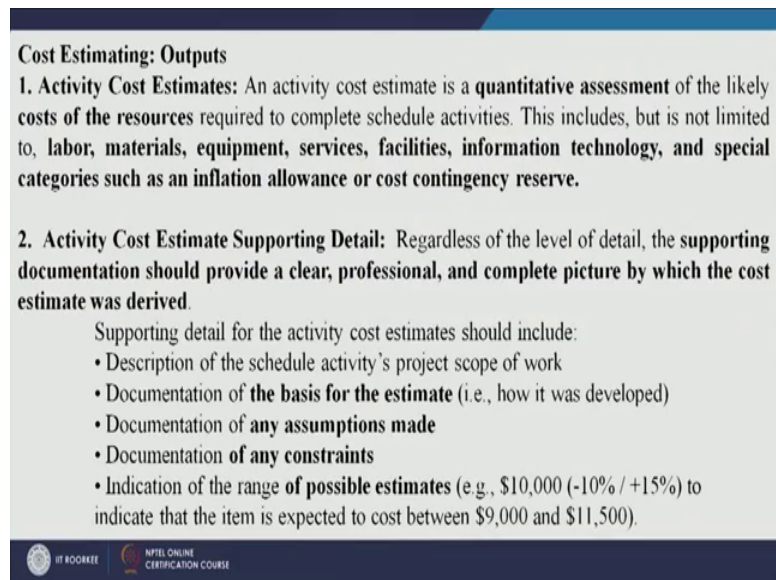
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5. **Project Management Software:** Project management software, such as cost estimating software applications, computerized spreadsheets, and simulation and statistical tools, are widely used to assist with cost estimating.
6. **Vendor Bid Analysis:** Other cost estimating methods include vendor bid analysis and an analysis of what the project should cost.
7. **Reserve Analysis:** Many cost estimators include reserves, also called contingency allowances, as costs in many schedule activity cost estimates.
8. **Cost of Quality:** Cost of quality can also be used to prepare the schedule activity cost estimate.

So, you have got MSP, you have got primavera and there are other simulation and statistical tools available, which will help you in finding out what is the cost of what is the estimation of estimated cost of an of a software of a project right. Then you got vendor bid analysis. So, when you are getting tenders from let us say different suppliers, let us say if you need some material, let us say if you want aluminum sheets right. So, you are you just float a tender and say that I need 10,000 aluminum sheets of this much size and this much thickness, and let the vendors apply to your query right.

So, those vendors will quote different prices. So, from those prices also you can get an idea what would be the cost of aluminum sheet right. So, that is just an example you can apply this vendor bid analysis in any other situation as well right. Then you got reserve analysis. As I said initially you do not know much about feature. So, you keep more and more reserve for unplanned expenditures or contingencies that is another good source to know the cost estimation of an activity right. Then you got cost of quality of course, quality is quiet an important accept of a project and there are different costs related to quality.

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Cost Estimating: Outputs

1. Activity Cost Estimates: An activity cost estimate is a **quantitative assessment** of the likely **costs of the resources** required to complete schedule activities. This includes, but is not limited to, **labor, materials, equipment, services, facilities, information technology, and special categories** such as an **inflation allowance or cost contingency reserve**.

2. Activity Cost Estimate Supporting Detail: Regardless of the level of detail, the **supporting documentation** should provide a **clear, professional, and complete picture** by which the cost estimate was derived.

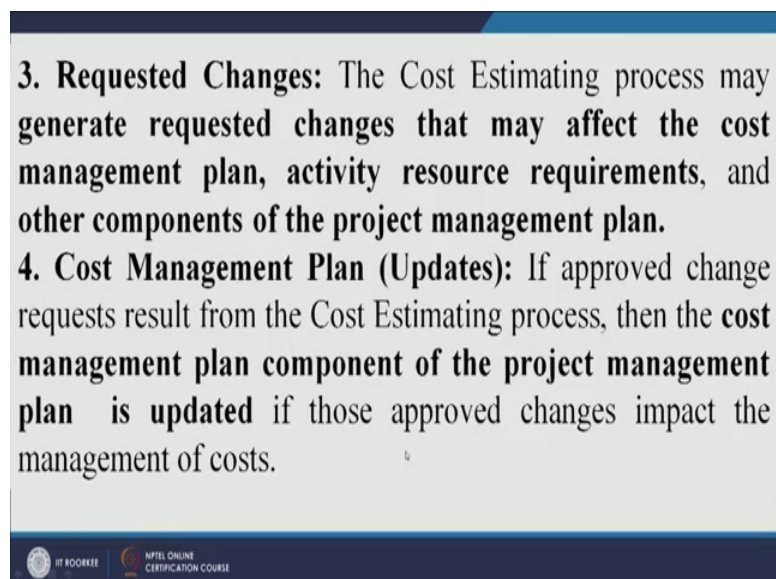
Supporting detail for the activity cost estimates should include:

- Description of the schedule activity's project scope of work
- Documentation of **the basis for the estimate** (i.e., how it was developed)
- Documentation of **any assumptions made**
- Documentation of **any constraints**
- Indication of the range of **possible estimates** (e.g., \$10,000 (-10% / +15%) to indicate that the item is expected to cost between \$9,000 and \$11,500).

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So, these are all about tools and techniques and there are certain outputs of cost estimation, we will not going to details of these outputs you just see this activity cost estimates you have got activity cost estimate supporting details.

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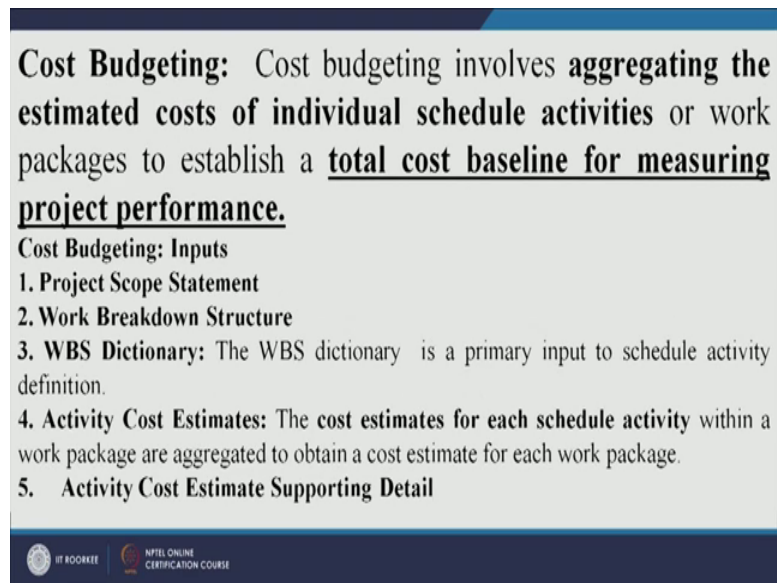
3. Requested Changes: The Cost Estimating process may **generate requested changes** that may affect the **cost management plan, activity resource requirements, and other components of the project management plan**.

4. Cost Management Plan (Updates): If approved change requests result from the Cost Estimating process, then the **cost management plan component of the project management plan is updated** if those approved changes impact the management of costs.

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So, these are the different details right. You have got requested changes you have got cost management plan right. I will not discuss about these outputs.

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Cost Budgeting: Cost budgeting involves **aggregating the estimated costs of individual schedule activities** or work packages to establish a **total cost baseline for measuring project performance.**

Cost Budgeting: Inputs

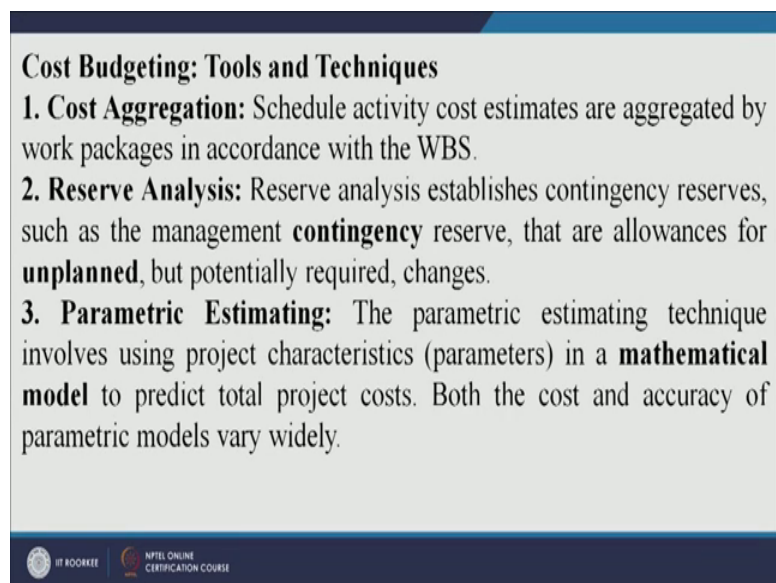
1. Project Scope Statement
2. Work Breakdown Structure
3. **WBS Dictionary:** The WBS dictionary is a primary input to schedule activity definition.
4. **Activity Cost Estimates:** The cost estimates for each schedule activity within a work package are aggregated to obtain a cost estimate for each work package.
5. **Activity Cost Estimate Supporting Detail**

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Let us move on to second important process right. The first one was cost estimation the second is cost budgeting. So, you have got several inputs for cost budgeting right. So, it is cost budgeting it is basically the aggregating the estimated cost of individual activities right. So In fact, you will have the total cost baseline for at the end of the day total cost and against which will you measuring performance of the project. So, there are several inputs you have got projects scope management work break down structure WBS directory activity cost estimates activity cost estimate supporting details right. So, we will not look at all these inputs right. We are interested more in tools and techniques right.

So, you have got projects due resource calendar contract cost management plan.

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Cost Budgeting: Tools and Techniques

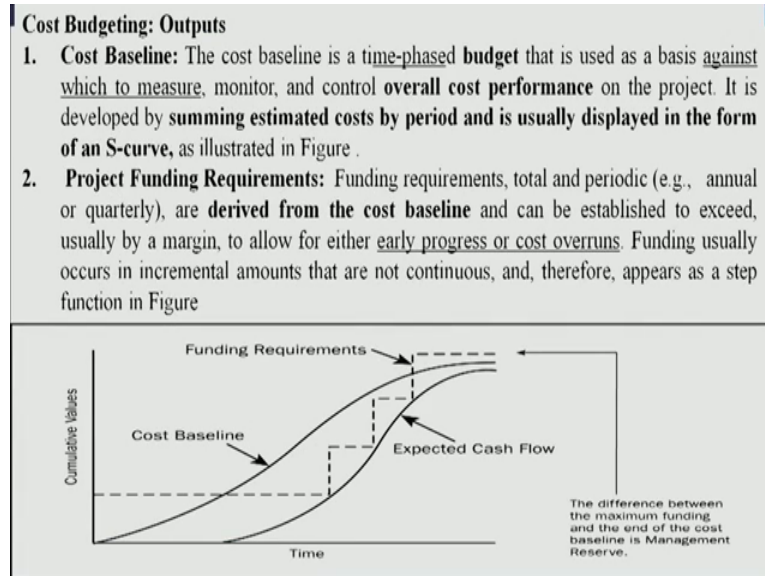
- 1. Cost Aggregation:** Schedule activity cost estimates are aggregated by work packages in accordance with the WBS.
- 2. Reserve Analysis:** Reserve analysis establishes contingency reserves, such as the management **contingency** reserve, that are allowances for **unplanned**, but potentially required, changes.
- 3. Parametric Estimating:** The parametric estimating technique involves using project characteristics (parameters) in a **mathematical model** to predict total project costs. Both the cost and accuracy of parametric models vary widely.

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Let us look at tools and techniques right, for cost budgeting. So, how to prepare budget? So, there is something cost aggregation right. So, you have got you know on the cost of different activities, you just aggregate those cost right. It will give you an idea about budget of the project right. Reserve analysis has you seen in cost estimation also. So, reserve analysis is for contingency and unplanned expenditures. In fact, if the project is far from city then you need to have more and more contingency and unplanned expenditures right.

Parametric estimation as I talked in previous case also. So, you have got different statistical and mathematical models available which will help you in finding out budgeting of the project right.

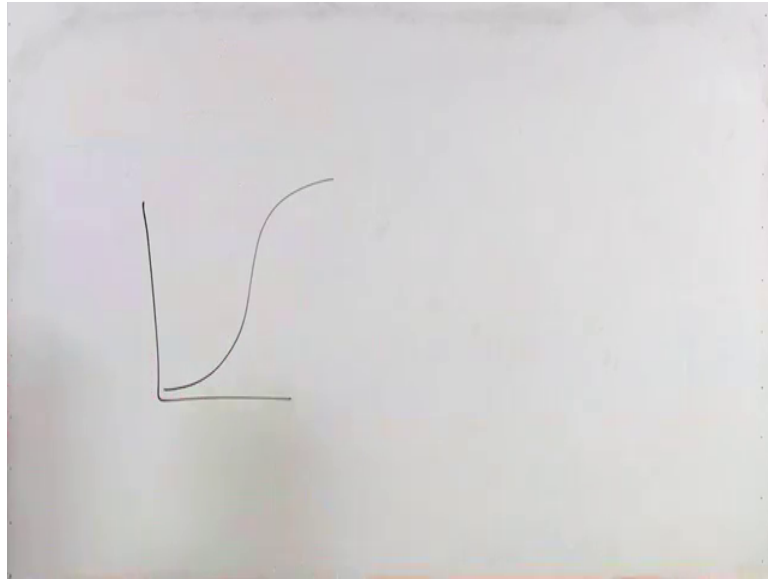
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Let us look at cost budgeting outputs, because these 2 are very important. So, let me talk about these two. So, you have got cost baseline at the end of the day, cost baseline, it is nothing but time phased budget that is used as basis against which to measure monitor and control overall cost performance. So, at the end of day you have got a cost baseline against which we will measure how our project is progressing right. So, cost baseline is important it is there it is there in this figure right. So, this is nothing but cost baseline right.

So, how we prepare it? It is developed by summing estimated cost by period and is usually displayed in the form of an S curve. So, if you look at this curve carefully it is looks like an S curve right.

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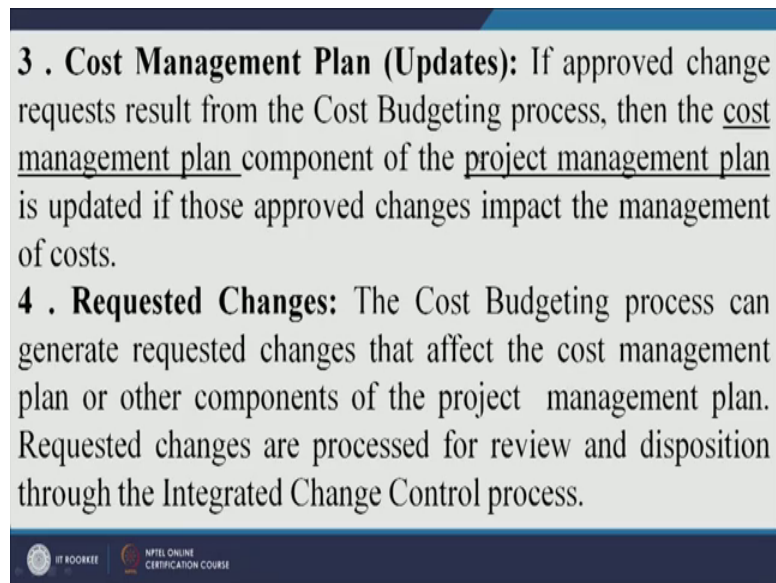


Isn't it? S shape right. I will show it on board looks like this right. And S shape right? So, it is developed by summing estimated cost by period and is usually displayed in the form of an S curve right. So, this is your cost baseline right.

Then second output is project funding requirements. Actually funding requirements would be there in different phases or in different steps right. So, funding requirements total and periodic it, In fact, funding requirement may be either annually or you know twice in a year or 4 times in year or monthly right. So, it would be different it would have different periods right. So, these are derived from the cost baseline and can be established to exceed usually by a margin to allow for either early progress or cost overruns.

So, if you look at these dotted lines just look at this one right. This dotted line right. So, this is a step function. So, you are getting funding requirements in different steps right. So, if let us say this is the total cost of the project right. This point the corner point of cost baseline and if the funding available is this much. It means very surplus with you right. And this surplus is known as management reserve right. So, you have got more funds than total cost right. If you are some were here, it means you have you have got less funds right. So, this is these 2 are important points. So, you just look at carefully cost baseline and project funding requirements right.

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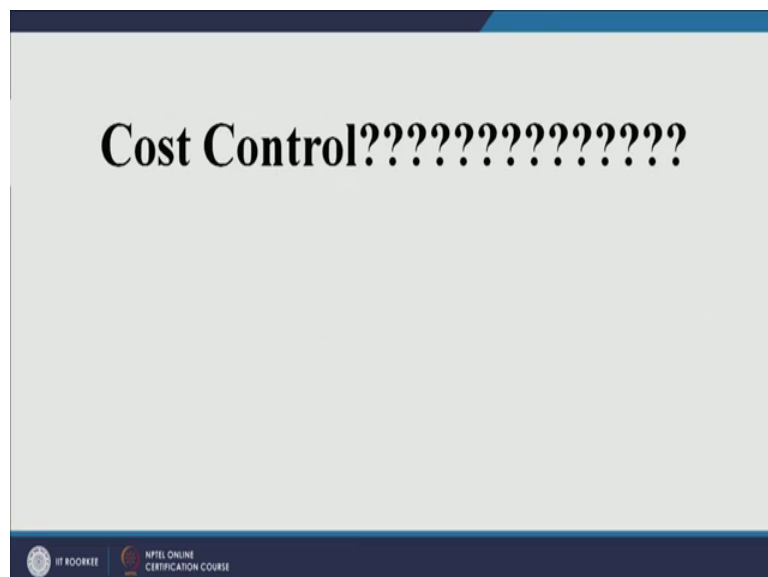
3 . Cost Management Plan (Updates): If approved change requests result from the Cost Budgeting process, then the cost management plan component of the project management plan is updated if those approved changes impact the management of costs.

4 . Requested Changes: The Cost Budgeting process can generate requested changes that affect the cost management plan or other components of the project management plan. Requested changes are processed for review and disposition through the Integrated Change Control process.

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Cost management plan of course, cost management plan means if approved change request result from cost budgeting process, then cost management plan component of the project management plan is updated anyway, you just look at that there is something called cost management plan. And the fourth is requested changes only there are 2 important points in cost budgeting output, cost baseline and funding requirements right.

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Cost Control????????????

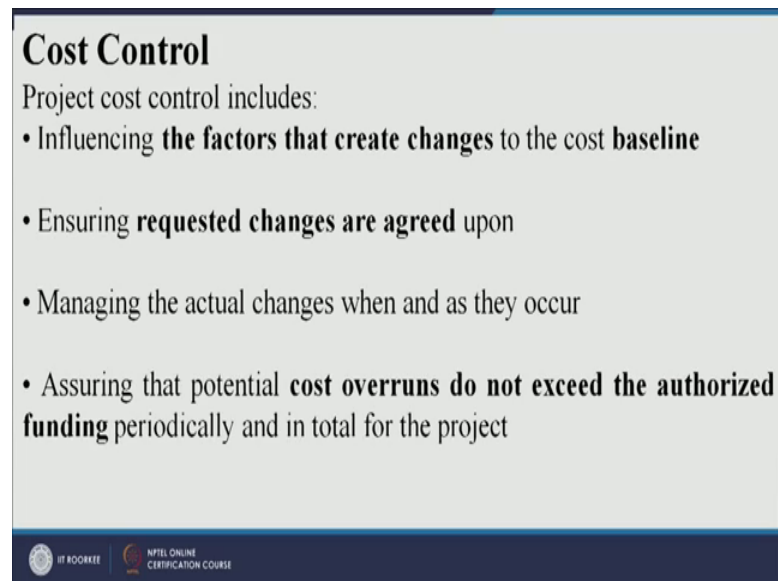
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In fact, if you look at the next one the third important process is cost control. In cost control if you look at this, this very important, because in most of the projects you will

get at the end of the day you will have shortage of funds right. So, you should start controlling cost right from the beginning right.

So, when I say cost control means you need to look at those factors which affect your cost baseline right. Control them carefully.

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Cost Control

Project cost control includes:

- Influencing **the factors that create changes** to the cost **baseline**
- Ensuring **requested changes are agreed** upon
- Managing the actual changes when and as they occur
- Assuring that potential **cost overruns do not exceed the authorized funding** periodically and in total for the project

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Look at what are the reasons for cost overruns. And whenever there is some cost overrun you should ensure that proper approval has been taken for that cost overrun. Let us say if for an activity 100 rupees is sanctioned right. And you have spent 150. So, you should ensure that you taken permission for spending extra 50 rupees right. So, proper approval should be there.

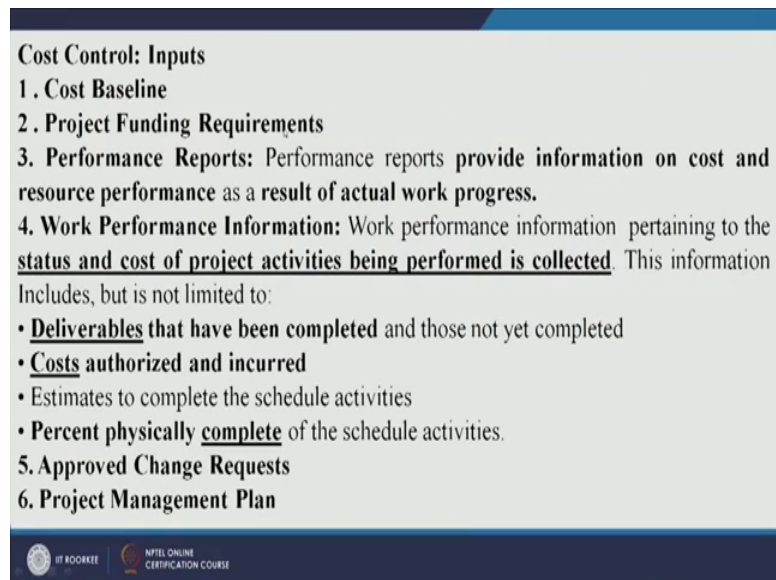
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- Monitoring cost performance to detect and understand variances from the cost baseline
- Recording all appropriate changes accurately **against the cost baseline**
- Preventing incorrect, inappropriate, or unapproved changes from being included in the reported cost or resource usage
- Informing appropriate stakeholders of approved changes
- Acting to bring expected cost overruns within acceptable limits.

Monitoring cost performance of course, you need to monitor it to detect and understand variances from the cost baseline. So, you know that cost baseline is nothing but you know that at this particular point of time this should be the cost of the project right. And if there is any deviation then you should find out why that deviation is occurred what are the reasons for those that particular deviation right.

Preventing incorrect inappropriate or unapproved changes from being included in reported cost or resource usage; informing appropriate stakeholders of approved changes right. So, these are couple of things you should be careful about cost control. Say if there are several inputs cost baseline is one of the inputs.

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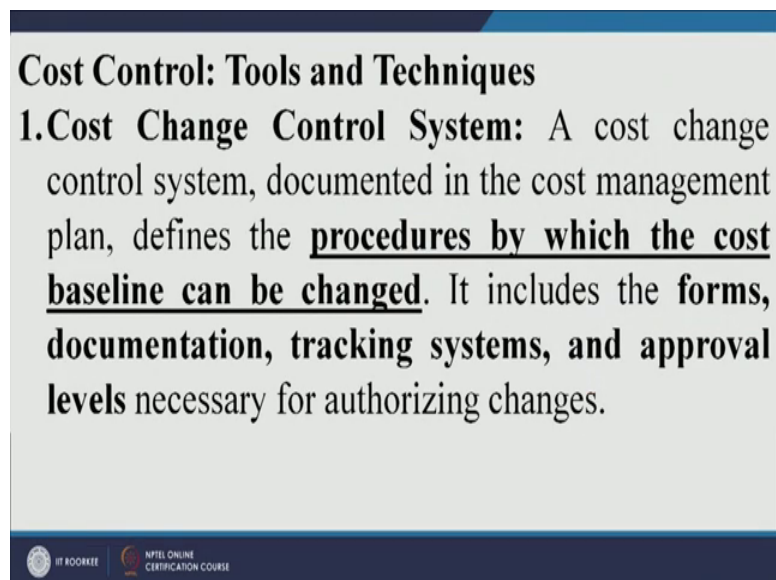
Cost Control: Inputs

1. Cost Baseline
2. Project Funding Requirements
3. **Performance Reports:** Performance reports provide information on cost and resource performance as a result of actual work progress.
4. **Work Performance Information:** Work performance information pertaining to the status and cost of project activities being performed is collected. This information includes, but is not limited to:
 - Deliverables that have been completed and those not yet completed
 - Costs authorized and incurred
 - Estimates to complete the schedule activities
 - Percent physically complete of the schedule activities.
5. Approved Change Requests
6. Project Management Plan

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Then you got project funding requirements and there are so many. So, we will not look at these inputs, we will focus on cost controls tools and techniques right.

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Cost Control: Tools and Techniques

1. **Cost Change Control System:** A cost change control system, documented in the cost management plan, defines the procedures by which the cost baseline can be changed. It includes the **forms, documentation, tracking systems, and approval levels** necessary for authorizing changes.

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So, first is cost change control system. Cost change control system is documented in cost management plan. It defines the procedure by which cost baseline can be changed, because cost baseline would be drawn you know you know very early in the project. So, if you want change your cost baseline then you needs to follow a particular procedure. Some, some documents are to be signed some, some approvals are needed there are some

formats. So, you need to look at all those things if you want to change your cost baseline right. So, cost change control system is basically a process by which you can change your cost baseline.

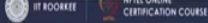
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Cost Control: Tools and Techniques

2. Performance Measurement Analysis: Performance measurement techniques help to assess the **magnitude of any variances** that will invariably occur.

The earned value technique (EVT) compares the value of the **budgeted cost of work performed** (earned) at the original allocated budget amount to both the **budgeted cost of work scheduled** (planned) and to the **actual cost of work performed** (actual). This technique is especially useful for cost control, resource management, and production.

An **important part of cost control is to determine** the **cause of a variance**, the **magnitude** of the variance, and to decide if the variance **requires corrective action**.



Then you have got performance measurement analysis, this is very important. When you when you go for a project you need to check whether your performance is as per planning or not as per planning not, only in terms of time, but in terms of cost as well as in terms of performance also right. So, performance measurement techniques help to assess the magnitude of any variance that will in invariably occur.

So, one of the techniques is earned value management are EVT earned value technique right. So, earned value technique is basically compares the value of budgeted cost of worked work performed at the original allocated budget amount to both budgeted cost of work scheduled and the actual cost of work performed right. So, this is earned value technique we will take up an example on earned value management. In fact, earlier it used to we known as EVT, but now it is called earned value management approach right.

So, an important part of cost control is to determine of course, cause of variance it is magnitude not only the variance, but how good or how bad that variance is right. If you are completing project before time that it is good variance right in a way. So, you need to know the variance as well as magnitude of you needs to know the direction and

magnitude of the variance right. So, there are couple of important points which should be noted in this earned value management technique.

We will discuss about those points in next session for the time being let me stop here.

Thank you very much.