Project Management: Planning, Execution, Evaluation and Control

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Welcome to the course Project Management Planning, Execution, Evolution, and Control. I am Professor Sanjeev Choudhary from the Indian Institute of Technology Kharagpur, in continuation with module 5, that is estimating project time and cost. In this lecture, we will be covering level of details, type of cost and refining estimates. The cost concepts that will be covered in these lectures are bottom up estimation, methods for estimating project time and cost, then level of detail, types of cost in a project, then refining or adjusting the estimates. To start with in the last lecture, we have talked about what is top down approach for estimations.

There are 4 types of methods are there 4 or 5, 6 types of methods were there we have talked about it. In bottom up approach, we have these are the different types of methods say template method, parametric procedure, range estimates and phase estimating. We will discuss all these 4 one by one. To start with let us discuss the template method.

Template method is one wherein you have the similar type of projects, you have the experience, you have done it in the past. So, you have some data allow with you take that and you make a template sort of things on that. For example, say dry docking shipyard in that now the project is to maintenance of the project overhauling of the ship, overhauling of the major components of the ship. So, you have a template and you go to you inspect your new project, new ships and all then you make out that what are the areas you need to you need to repair or what are the time duration it will be taking, what are the cost it will be taking. So, you look at it and the fill up the template.

So, this is a template. Similar experience you must have had in the auto garage for servicing your car, for repairing your car, there also you will find they have a template for

engine in that there are different parts of the of the car are listed. Say engine part what are the jobs that has to be done, then the chassis the and the other parts of the hydraulics and all breaking system, all those system air condition systems all these things are there. They quickly look inspect your car and what are the damages done, what are the repair adjustment has to be done, they quickly put a rough a quick estimate and also the duration to be done. This is called template method.

Then other one is the parametric procedure. What is parametric procedure? Parametric procedures are similar to your ratio method. In the ratio method we have seen that that is also called a parametric one. Here it is similar to that. Suppose you are having in your office 36 workstations.

Now your manager who know the once to convert these 36 workstations, the convert this to the MS office and all. So, they try to do that and he knows that one software engineer can convert 3 workstations per day. So, so, so what will be the how many days it will be taking. So, you have 30 this is this parametric 36 workstations and the you have you have 3 software engineers. One software engineers can convert 3 workstations in one day.

So, it will be 36 by 3. So, how many days you have if you have 33 software engineers it will take 4 days. This way you can find out. Similar way suppose you wanted to paint the exterior of your buildings. So, suppose you know the per square feet per square feet material cost for painting suppose is rupees 40 is the painting cost that is the material cost.

And if you if rupees 10 per square feet 10 SFT per square feet is the is the cost for the labour charges that is rupees 50 per square feet rupees 50 per square feet. Now suppose your exteriors are exteriors of the building is saying 8000 exteriors area is 8000 square feet. So, what will be the cost? Cost will be the total cost will be cost will be 8000 SFT into 50 equals to 400,000 rupees that is 400000 rupees. This is called parametric procedures. Now next are the range estimates.

What is range estimates? Range estimates is done when your work packages are very uncertain you do not know those how long-time cost resources will be requiring for your

work packages for work packages. In such situation what you do? You do you make a range of estimates it may be low estimate high estimate and average estimate. Now you have a low end you have a high end. So, you suppose the work package will take low estimation is 1 day and the high estimation is 3-day average may be in between. So, you make a range estimate and how do what is the best way of doing the range estimate because since it is uncertain the you deploy a group of people instead of one people.

One people you put it when your work packages are certain like uncertainty is very low then you go for can go for an individual estimator, but when the uncertainty is high it is better to deploy a group of people to estimate that range that this is similar to low high and average this is similar to that part you know part estimates. We will talk about the what is part and all it is in the next module 6. So, it is it has a 3-time estimates are similar to that you use this range estimates. Then there are phase estimating phase estimating is when do you use phase estimating the when your final deliverables are uncertain design is uncertain you do not know what will be your end product or end result that time you do a phase estimation. I will show you the show you the phase estimations explain you more.

This is a phase estimating over product life cycle say when as I told you the basically you will find it the highly complex project suppose new technology or aerospace projects and all or the software projects here you have divided in phases say phase 1, phase 2, phase 3, phase 4, phase 5 that is the need specification design prototype and deliver. So, you do not know what is will be your scope of work the final deliverable is uncertain you do not have any idea design also you do not have any idea. So, what you do you do a combinations of macro estimate and micro estimate what is that macro estimates you first do a macro top down estimate. Now as you proceed for the immediate phase you do the detailed estimates and the rest of the phases you make a micro estimate because you are not knowing what will be the end result or the end deliverable. So, similarly say you do the detailed for phase 2 rest are the macro estimate same when you go to the phase 3 design you do a detailed estimate of phase 3 and rest you do a macro estimate after you finish phase 3 you do a detailed estimates for the phase 4 and macro estimate for phase 5.

So, this way it is a combinations of macro estimates and detailed estimates. So, here when your project deliverables are not certain you do not know and when your designs are also not known then you use this of sort of phase estimating estimations. So, these are the 4 types of bottom up approach that is template methods, parametric procedures,

range estimates and phase estimates. Next, we will be comparing this top down and bottom up estimates whatever we have discussed so far. If you compare top down versus bottom up say top down estimates who are the what are the intended use? Intended use is during the feasibility conceptual phase you do the top down estimate it is a rough time and cost estimates and what will be the initial fund requirement, resource capacity planning that you do it and the bottom up estimates you do it for more accurately for budgeting for preparing a schedule for preparing your resource requirement and cash flow fund timing when you will be time phased budget.

So, you do it for preparation cost for top down estimates are less it is 110 1 by 10 to 3 by 10 of a percent of total project cost whereas, preparation cost of bottom up estimates a bit higher 3 by 10 of a percent to 1 percent of total project cost because as you improve your accuracy cost also manpower requirement also increases. Accuracy for top down estimates are from minus 20 to plus 60 and accuracy improves in the bottom up estimates it is double improvement like minus 10 percent to plus 30 percent. The methods as we discussed for the top down estimates are consensus method, ratio method, apportion method, function point and the learning curves whereas, in bottom up estimates we use template method, parametric method, work breakdown structure packages and that that is the range estimates and the phase estimations. These are the comparison between top down estimates and bottom up estimates. Next, we will talk of the level of details what you will be requiring.

What should be the level of details? Basically the level of details is needed different for different level of management different level of details are required say for the top management, senior management they will not be bothered for the for the more detail granular details and all they will be bothered about the top things like major deliverables whether they are on time or whether they are on course of budget whether they are under budget or the over budget or ahead of schedule or and or behind the schedule they will be interested for that. For the managers level they will be interested for their specific deliverables say each manager will have their own deliverables and all then the team leader below this thing they will be the contended with or they will be looking for their sub deliverable this way it goes and the lower level management responsibility they will be looking after one that work package. So, the level of details will be different for different level of management then and also project complicity the WBS when your work breakdown structures and all are doing it. So, level of detail in WBS also depends on the complexities of the project suppose an aerospace project or the high-tech projects and all or the satellite project and all these are much more complex than an ordinary say product development ordinary say consumer goods product development and all or the

campaigning the marketing campaigning project. So, the project complexities also determine what should be the level of details and say new technology and all unfamiliar things and all that details may be there may be more complex and may be more granular things one wants to know.

Then what are the effect of excessive detail? There are excessive detail getting too much of information and all this is costly because it focusses on the department you know people will be more concerned with that if it is excessive detail with their departmental objectives departmental work and all and forget the overall project requirement and also excessive details become generates or degenerates unproductive paperwork. Then insufficient detail having insufficient detail is also costly and is not desirable what does it affect it lacks the focus if you have insufficient detail it will focus will be lost or misguided efforts and you will be more concerned your more efforts on non-essential activities. So, the details level of details will be appropriate for appropriate level of management and also these details also depend on the complexities of the project. Then there is what are the different types of cost in a project? So, there are generally three cost those are assigned to three cost of a for computing a project cost that is the direct cost direct project overhead cost and general and administrative overhead cost these are the three cost one what is the direct cost in the project can you answer it? Direct cost is the one which is can be assigned to the work package with whatever is assignable to the work package is called direct cost. For example, labour, material, equipment these are directly assigned to the work packages.

So, these are the direct cost another is the direct project overhead cost which is directly linked to the overhead cost though directly linked to the project say for example, direct overhead cost salary of the project manager, rented office in the field the project office in that is taken on rent for the for completions of the project that is also a direct project overhead cost. Also, specialized equipment's or tools that has been hired or purchased procured for the particular this project these are we attributed to direct project overhead cost. Then another two cost of the projects are the general and administrative overhead cost. These overhead costs cannot be directly assigned to the project, but it is assigned indirectly to the project certain percentage of the direct project overhead cost or direct cost that is assigned. So, he for example, this is the for example, it is advertising for your project then the accounting systems with at the head office then maintained at the head office then the senior management who are supervising the project their executive time their salary cost and all these are taken into account a certain percentage of the direct cost of the project or the direct project overhead cost.

This is this differ this percentage is different for different organizations and for different type of the project say generally it is taken as 10 to 20 percent it may differ also these are the three types of cost for a project. Then further we will be when you are making a cost estimates for a project for a contract bid for a competing a fixed price contract for there you are bidding it. So, you have to employ a bottom up approach to estimate your bidding price and all. So, what are this is an illustrative one which is being shown here what are the cost that generally you will look at it one is the direct cost. Suppose it is 120,000 dollar then direct overhead cost it is 30,000 dollar that gives you the direct total direct cost then there may be the GNA that is that general and administrative overhead cost it is taken as a percentage say 20 percent of the total direct cost.

So, it is 30,000. So, total cost comes around 180,000 dollars now you keep your profit margin for bidding. So, it is 15 percent taken 27,000 of the total cost 180,000 15 percent. So, total bid cost you bid for 207,000 that you your bidding cost that this way and then you develop you're the project cost this is an illustrative one. Now next one we will be discussing why do you refining the estimates, why do you refine the estimates or why do you adjust the estimates that is also being done because say the hidden interaction cost you know like the when a project is being done say a design engineers have done the design part then it goes to the prototype production. So, but it is not in real life it is not that simple it does not go in one go when the prototype and all they start producing they come across many hurdles.

So, they might have to adjust the design for that they go back to the design engineers design department and there may be lot of interactions goes on lot of meetings goes on it is a to and from or movement. So, it is so these interaction costs are hidden. So, for that if the changes suppose there is some design flaw or something else it may require the coordination of many departments when more departments are to be coordinated what happens the that there may be the executive time meetings has to be arranged briefing has to be done to the top management all these are the hidden interaction cost those are not reflected in your work package. So, these may require adjusting the estimates or refining the estimate. Similarly, the estimates work packages are done estimates done as a considering normal conditions, but the normal conditions as I told you earlier it is using efficient methods and using normal resources.

Normal resources we have given the example before suppose if you require 5 bulldozers, but you have only 3. So, normal condition does not exist the equipment may be break breakdown may take place. So, it will increase your durations of the project. So, you need refining and adjusting your estimates then things that may go wrong equipment breakdown that the weather inclement weather there may be accidents this is

not in your hand this may anything can go wrong. So, that also require some adjusting the estimates the changes in project scope of plan as the project is being implemented.

So, as you go further and further deeper and deeper project manager come to know many new things and that he wants to incorporate it for the betterment of the project. Suppose new technology new things also the clients may be insisting for changes as per the as per the changes in the market. So, all these require change in project scope and plans usually if your project scope is broad then this may happen more frequently. So, that is why you should have a very unambiguous and specific project scope. In such cases you require the refining and adjusting then the optimistic estimates like if I tell you how fast you can do this job you will tell it say very an optimistic view sir I can do it within 5 days.

If the same questions is asked how long you will take to do this job you may say that it is a it will take 10 days these are the research findings and all. So, you are giving an estimate are generally the optimistic. Then strategic misrepresentation what it is like it has been found that to win the approval for the project you know many stakeholders what do they do they misrepresent strategic misrepresent in the sense they will tell the under tell the underestimated cost and benefit they will tell in the overestimated of benefit they will this for the winning the approval. So, this is particularly especially you will find it true for public works and all you know to make a bridge to approve a dam to approve a public buildings and all they generally misrepresent for the that is why you will find the most of the public works are over that behind the schedule that takes more duration than the plan and that is the over cost that takes more budget the approved more than the whatever it was approved. So, these are the need for defining and adjusting estimates.

The lastly create a database for estimation what it is the database like good companies like IBM and many other companies say they maintain that maintain a database of the past projects and all. So, the database also you have the work packages and all. So, when you go for a new project and all you have the past data what are the work packages and all will take time cost and all it will become easier for you to estimate the new project. So, you need to create a database for estimation good companies they generally have it. So, this is the illustrative structure of a database for estimation this is the estimating database it has the documentation programming risk analysis all the things you can do it from this and this is the documentation say estimated actuals on labour material equipment benchmarking ratios all this and this is just an illustrative one.

Now after finishing this we will be solving two simple problems this problem we will be solving now. This is a simple problem you just go through it. It says calculate the direct cost of labour for a project team member using the following data. What is the

data? Hourly we have talked about it we have learnt it. Hourly rate is 40 hours needed are 80 hours overhead rate is 40 percent what will be the answer just solve it yourself.

I will be solving it now, but you close your video at this point and first you solve it yourself. Then you see the actual answers what I will be doing it. So, hourly the so, what is the thing direct cost of labour direct cost of labour direct cost of labour equal to 40 dollar per hour into hours needed is 80. So, it will be 3200 dollar it is a very simple people do it wrongly you know they also include overhead rate in that it is not right. This is the here if you do the overhead rate that is called total direct cost equal to 3200 into what it is 40 percent.

So, 40 percent is 3200. So, it will be 3200 into no no this this will be this will be plus into 0.4 40 percent. So, this will become how much 4480 this is a simple problem direct ok. This you can do it the I will solve another problem now that this is another problem you just go through this problem then we will be solving it. You go after going through you try to solve it yourself.

The problem says Mrs. Tolstoy and her husband Sari are planning their dream house. The lot for the house sits high on a hill with a beautiful view of the Appalachian Mountains. The plan shows the size of the house to be 2900 square feet. The average price for a lot of lot and house similar to this one has been 120 dollar per square feet. So, you can take that ratio method the average price ok.

Fortunately Sari is a retired plumber and he feels he can save money by installing the plumbing himself. Mrs. Tolstoy feels she can take care of the interior decorating. The following average cost information available from the local bank that makes loans to local contractors. So, it is 2400 for the executions and framing, 8 percent roofing, 3 percent wiring, 6 percent plumbing.

So, we will be requiring what plumbing is the. So, what you will be requiring you will be requiring this 6 percent plumbing, then another windows insulation furnace 4 percent plumbing and the interior is done 4 percent interior. So, the question says what is the estimated cost for Tolstoy's house if they use contractors to complete all of the house. So, the what will be the cost for the Tolstoy's house if the contract gives everything to the constructor the then it will be estimated cost of the house will be simple 2900 square feet into 120 dollar per square feet per SFT. So, it will be simple how much if you multiply these 2900 and 120 square feet it will be 348000 dollars if they want to give everything to the contractor. Now the this is the part A, A we have done it estimated cost for Tolstoy's house come when the contractors are given.

Now estimate what the cost of the house would be if Tolstoy use their talents to do some of these works some of these works is this 3 their plumbing then your plumbing 6 percent plus 4 percent then the interior decorating by wife 4 percent. So, if they estimated saving estimated savings for plumbing percent interior decorating will be how much 6 percent plus 4 percent plus 4 percent equal to become 14 percent ok. So, estimated therefore, estimated they can say 14 percent estimated total cost for completing for completing the house using their talents talents equal to how much 348000 into 0.

86 no they equal to how much it becomes dollar 299.28000. So, they can do it if they do it by themselves. So, you solve it yourself then you look at the answers. So, we have solved these two problems. So, we summarize the today's lecture here we can say in continuation with the previous lecture this session discusses the bottom up approach and estimations of time cost and resources. It further elaborates why estimating time and costs are important then it also explains the level of details that shall be different for different levels of management.

Excessive details increases unproductive paper work and less details tend to loss focus and opportunities. This module further illustrates that there are three types of cost associated with the project and these are direct cost, direct project overhead cost and general and administrative overhead cost. It also elaborates the need for refining adjusting estimate as there are hidden interaction cost and other cost and importance of creating a database for estimations. These are the references you must go through these books to enhance your knowledge further on this subject. Thank you very much for attending today's class.