Project Management: Planning, Execution, Evaluation and Control

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Welcome to the course Project Management Planning, Evolution and Control. I am Professor Sanjeev Choudhary from Indian Institute of Technology, Kharagpur. In continuation of the module that is module now reducing project duration that is crashing activity. In this lecture we will be discussing how to crash, crashing that reducing project duration how to do that. So, we will be discussing before that what are the types of project cost, then project cost duration graph we will be talking about this if after explaining this in the subsequent lecture we will be solving some problem to demonstrate how to reduce project duration to reduce and to reduce project cost. So, to start with the project cost we all know there are two types of cost one is project indirect cost another is project direct cost.

What is the project indirect cost and what are the effects of crashing activities on indirect cost? We have already talked about the project direct and indirect cost. Project indirect cost are that overhead cost generally the overhead cost that is the supervision cost, administration cost, advertising cost, then the some consultants who are doing the projects for different projects and all. So, they are cost these are the cost called overhead cost and what are the effect of crashing activities on indirect cost that and before that I will talk about also what are the project direct cost. Project direct cost are the labour, equipment, material or even maybe the subcontractor which whose cost can be directly assigned to the work packages.

It can be directly captured, but project indirect cost cannot be assigned to the work packages. What we do? We take a percentage generally 20 percent or 15 percent of the total of the direct cost or the you assign it by the accountants and all afterwards. So, these are the direct cost and indirect cost for the project. So, now, we have we will answer what is the effect of crashing activities on direct cost and indirect cost? What happen? Is it increase or decrease or remain the same? So, we will be looking at it. It generally follows this sort of graph say the say indirect cost.

Indirect cost here it is the cost and it is the time x axis is the time. So, as the durations of the project increases indirect cost also increases because the indirect cost are your supervision, administration, then your overhead total overhead cost and all. So, these are dependent on

the duration. If you if you reduce the project then this cost will come down and per day cost for hosting having those project team. So, if it if it increases your indirect cost will increase.

So, and what is the direct cost? Direct cost generally decreases with the duration until it tapers or it makes a bit stabilizes. So, now, what happens? Now, if you see what is what is crashing? Crashing is you are reducing the duration means you are going this side. So, what happens when you are reducing the project duration your direct cost increases because you are coming to the from right to left and when you are reducing the indirect cost duration indirect cost reduces because you are going this side that duration is getting reduced and what is the total cost? Total cost is the direct cost-plus indirect cost. So, it is the total cost take a shape of this. So, this is the optimum period project duration.

We try to for crashing we try to come to find out this point this duration because if it if you further crash of the after attaining this this your cost will project cost will go high and also if you if you go to the right side again your total cost will increase. So, this is the crashing optimum project duration it is possible up to this and here you can find out there is one more cost is the opportunity cost. What is this opportunity cost? Opportunity cost are the project incentives or the bonuses suppose you complete the project early you some contract may be there you get some bonuses that is the opportunity cost and suppose in some contract if you delay the project contractor delays the project they have to pay penalty. So, those are the opportunity cost you lose that opportunity cost for the for the for penalty and all. So, these are the crashing activity and project completion time project time cost relationships is this.

So, the we have answered what is the effect of crashing activities on indirect cost and what is the effect of crashing activities for the direct cost this is clear. Now, we will be discussing crashing activity and project completion time activity crashing time cost trade off this is very important for the crashing purposes. So, activity crashing linear time cost trade off. So, we there is a we consider that that it follows a linear assumption is that the cost time follows a linear function is a linear function and also normal time is assumed as low-cost efficient method of working this is the normal time and the normal cost is the direct cost direct cost is the sum of the normal cost we will come to that bit later. Now, if we have to find out this slope why do you have to find out this slope because they you have to find out which one to be crashed which activity to be crashed you have to find out there are hundreds of activities thousands of activities in project which activity if you should crash for that you should crash first is the activities which are the critical activities because critical activities only will reduce your project duration non critical activity will not reduce.

So, critical activities have no slack. So, you choose the minimum slack activities. So, then after that there may be many critical activities which one you will choose you will choose

which cost least to you like the cost slope cost slope is nothing, but per day per day cost you incur for that activity. So, this how do you find it out here we say for this point it is say it is crash time and crash cost this is the Cc is the crash cost and say Tc is the time of crash time like this and this is the normal time normal cost normal time as I told you normal time is least cost and using efficient method of doing and normal cost is the cost as the doing efficient method at normal working conditions normal resource conditions this is the normal cost. So, you can see the crashing time has every crashing every activity has a limit for crashing further to that it cannot be crashed crash time is that limit threshold that beyond this time of that activity it cannot be further reduced.

So, this is the activity time activity cost. So, what is the slope we have to find out the slope of this. So, this slope is cost called crash cost per unit time though this is nothing, but the cost of crashing cost minus normal cost crashing cost will always be higher because you are your direct cost will increase you know you when you are compressing you have seen it and the by the time normal time minus crash time. So, this will give you the crash slope. So, I you can always write it down as we have we have shown here this the this the slope is this one crash cost minus normal cost divided by time normal time minus crash time.

So, it is nothing, but delta c means the increment in crash difference in crash cost and normal cost divided by difference of delta normal time by minus crash time this is the you have to find out for each activity then you choose the least activity least cost slope as the candidate for crashing ok. When you will be solving some problems in the next lecture it will be further clear to you. Now, this is the choice of activities to crash as I told you the what is this is the first what you do identify the direct cost to reduce project time then gather information about direct and indirect cost of specific project duration we have to we will be requiring it. Then search critical activities for lowest direct cost activities to shorten the project duration. So, you have to further then compute total cost for specific duration compare it and compare to benefits of reducing project times that is the total cost is what direct cost-plus indirect cost we will be solving some problems then this steps will be clear to you.

Now, further to it what are the choice of activities to crash that is we have talked about it in the previous slides the choice is the generally we go for the activities least slack activities which have the least cost, but again it may not be always preferable least cost if you have to go beyond the cost there are some other issues that goes beyond the cost. So, let us revisit that we which goes beyond the cost say usually we should even though it is a we preferably we choose the least cost activities, but we should avoid activities that are riskier to crash because may different activities have different level of risk suppose the risky activities if you want to crash it may have a problem for example, software design and coding in that if you crash what happens there are may be the chances probability will be more in the downstream

activities in the later on may be have more errors. So, it may be an error prone and that will be much costly. So, you must see the risk level of that activity before crashing then crashing sometime a more expensive activity is preferred if the there are few risk in this if the risk is very little then you may go for a more expensive activity which has a high cost slope that may be a possibility, but generally not done timing of activities also plays a role like crashing and activity early is preferred like the those activities which are at the beginning if you crash it first then that will give you the scope for the later activities to complete it first complete it early. So, timing of activities also plays a role then resource availability not resource availability is the major issue for selecting a selecting an activity that is to be crashed and it is not always the cost resource availability also influences the choosing of activity for the for crashing.

So, these are some of the you know it is not only goes beyond the least cost. So, this is in nutshell we have discussed today in this session the effect of direct and indirect cost on project duration has project duration and the construction of project cost duration graph and selection of candidate's activity that is activities for crashing has been discussed. Usually activity with minimum slack that is critical activity having least cost slope is chosen to crash the project duration and the process is repeated till the optimized time cost is repeated is reached we do that. Further the choice of activities to be crashed have been revisited beyond cost it is preferable to avoid crashing of high-risk activity even expensive activity may be crashed if it is less risky. Timing of activity and resource availability also influence the choice of activity to crash all these we have discussed.

Now, these are the reference books you can you can go through so, that you can enhance your knowledge further. Thank you very much for attending today's lecture.