Project Planning & Control

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Lecture – 13

Duration Estimation – Types, Inputs, Methods Parametric Estimation

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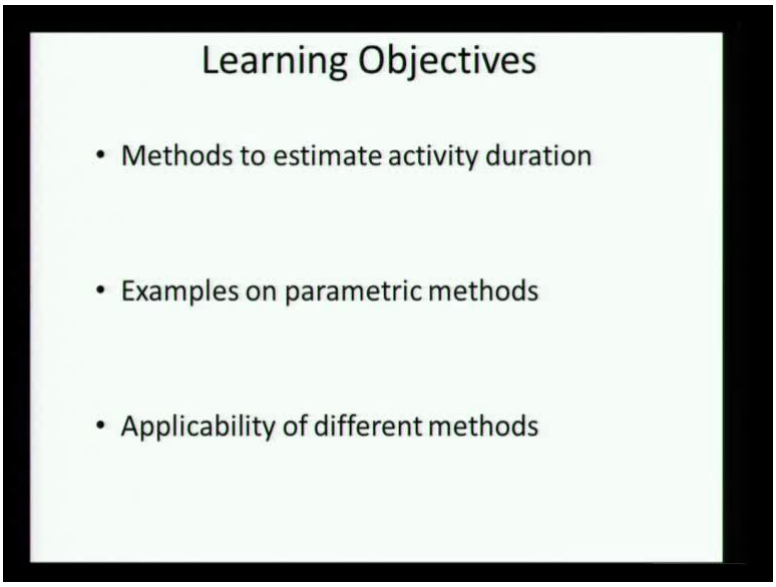

Lecture today is on duration estimation, and the objectives are to look at the methods by which we estimate activity duration, different examples of parametric methods, which we will use for the duration estimation and the end, we will have a discussion on the applicability of different methods. So, we have covered quite a few topics so far and all of these things like especially, when we did bar charts, we had to use duration. We are now going to see how, what is the way, method by which we can actually, calculate the duration of these activities.

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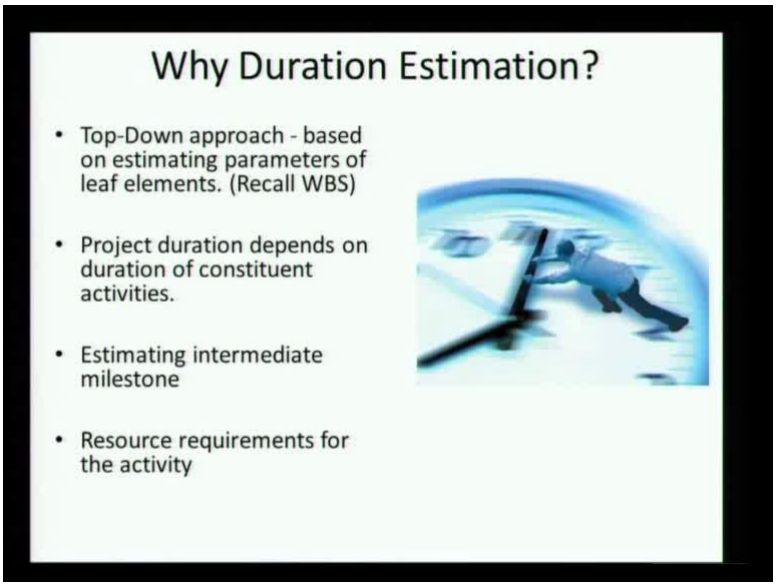

So, if you look at why do we need duration; any suggestions why do we actually, need the duration of activities?

Student: To calculate the whole duration of the project.

Yes. So, we actually come on the top-down approach. You remember, the work breakdown structure has leaves, at those leaves, are their activities, and only we calculate the duration of these activities; can we calculate project duration. That is the approach we are taken. Any other reason?

Student: (refer time: 01:21) based on the durations of each of these activities to drag the progress for example.

So, what we talk about is estimating intermediate milestones. So, it is not, we are not just interested in project duration; we are also interested in the detailed milestones of our progress. So, we needed for estimating milestones.

Student: (refer time: 01:40)

Right.

Student: (refer time: 01:42)

Exactly. So, only if you know duration at the activity level, we will be able to control the project and the resource perspective also. So, if we know when to mobilize the resources; when to need to demobilize; what kind of equipment are required at what stage; how much material should I order; all these things are also can be planned only if we know detailed

activity level durations.

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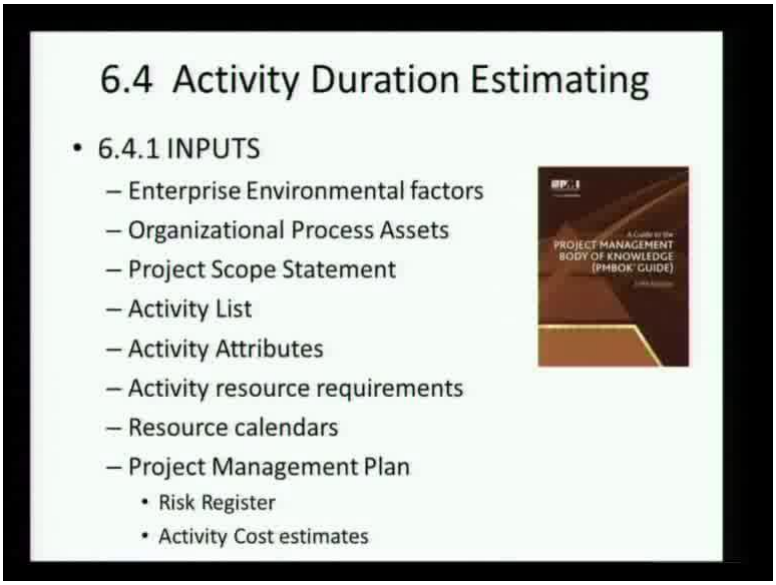

Now, if you go back to the PMI, which is the standard for project management, they have a section on activity duration estimating, and as per the PMI organization, you have inputs; you have tools and techniques, and you have outputs. If you look at, I am not going to spend a lot of time on this, but just to give you a list of the different inputs, which constitute our requirements for calculating durations. So, you can see, enterprise or environmental factors; organizational process assets; so, these have to do the company, what type of processes; what are the different tools and techniques we have in the company itself, you know, to do this.

Then as you come more detail project's scope statement; what is the scope of your project; activity list, activity attributes, activity resource requirements, resource calendars, the project management plan. So, I am just covering this to give you a broad idea of the various aspects that go into estimating duration. We will only look at a subset of this as we go ahead and then when we get into the tools and techniques, you have really a fairly wide range of tools. So, you have expert judgment; you have analogous estimating. So, the expert judgment means that basically, it is heuristic, you know, there isn't a calculation that I can do; I ask somebody who has done this before, the recent data, and we get his judgment on it. Analogous estimating is there is some data available, plus expertise. Parametric estimating is what we are going to cover most of this class, and that is a typical calculation, based on basic parameters. We will get to that. There is three point estimate, which we have seen PERT kind of applications. We will cover that also briefly. There is reserve analysis as PMI defines it, which is the buffer you give to your project duration. So, some of these like the reserve

analysis is not very well documented, but I put it there so that, we are aware that these techniques exist.

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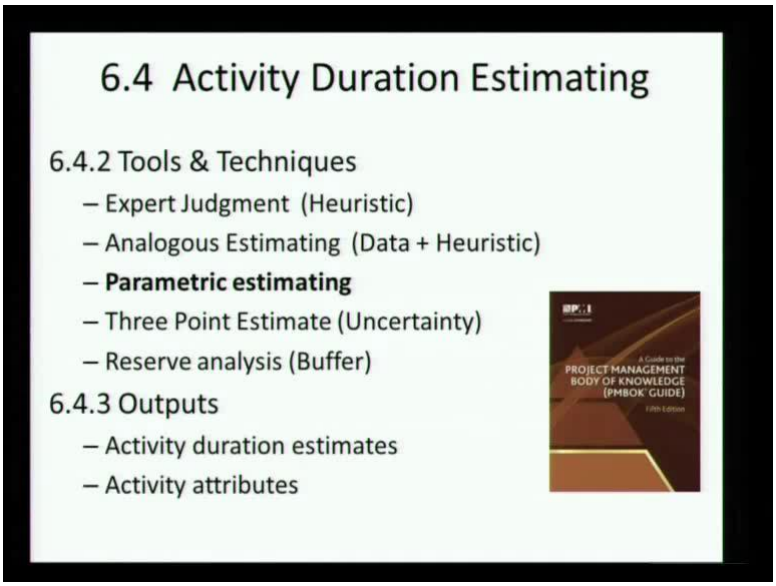

When you get to the outputs, you have obviously, activity duration estimation, estimates, and attributes, such as resources and other things which are required. Now, what we are going to cover like as I said for most of these classes, parametric estimating and I want to, and this is probably, the most scientific way, but it has its limitations. Let us get into a little more detail. So, you take a simple example. You can see; there is a car there.

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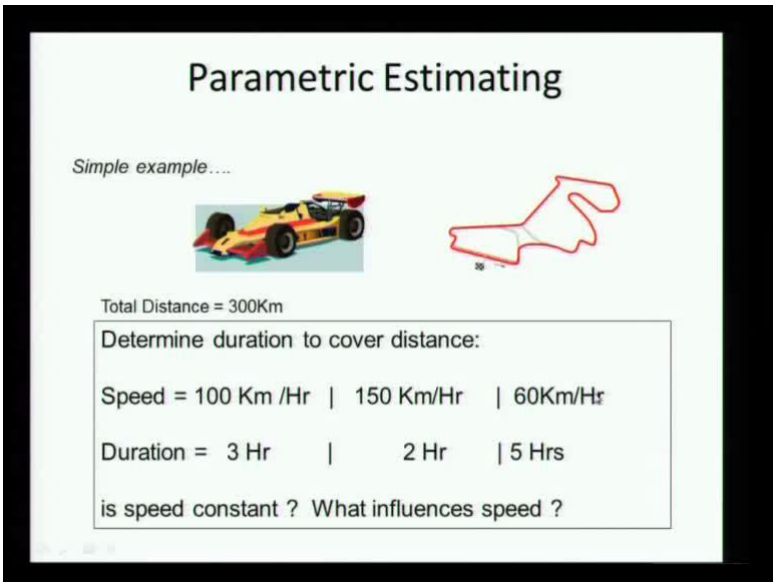

And it is supposed to do a track, and the total distance of the track is 300 kilometers, and I am

putting this in term of duration, right. Here also, the duration is an issue. I am drawing an analogy with something, which is very much more in physics, and we can build on that as we go. What do I need in this state to determine the duration?

Student: (refer time: 04:54)

So, I am giving you speed alternatives, and I only want the duration. I am not looking at the cost. I only want the duration. So, yes; I have my distance; I have my speed. For each of the speed, you can easily calculate, right; whatever the time and you just mentioned a very keyword, average speed. So, if we took we are assuming that all of the speeds, when we take the speeds, assuming it is an average speed; it is certainly not constant speed, but through this process, there have been lots of durations at the curves, especially, that speed will be much less; straight sections, speed, will be much more, and we need really some way to measure average speed. In this example, it is not that difficult to measure, because we have very good tools to be able to clock the speed at every time period. At the end of the circuit, we can say what the average speed is, but coming back; what actually influences the speed? We know it is not going to be constant. So, what actually influences speed?

Student: The technology of the engine and the motors.

Is that beyond and then I mean I can.

Student: If it is a straight road then (refer time: 06:12)

So, track influences the speed; what else? So, it is certainly the track.

Student: Driver also.

Driver influences; the driver, track, anything else?

Student: The environmental factors.

Yes.

Student: Really have the (refer time: 06:27)

Right. Environmental factors; wet track versus dry track; anything else during a race?

Student: The other opponents.

The other drivers around you will also influence speed. So, it is very dynamic. So, yes, if I knew the track, and I knew wet or dry condition, I can still estimate speed for the point, but now when I bring in other factors like there are others, who are going to be around me;

someone is trying to overtake me; someone is in front of me; someone is behind me; all of these also influence speed. So, it is very difficult to predict the speed at a given state, but again, this whole concept of average speed might be easier to estimate. And if we have an estimate of average speed only then, we can determine the duration.

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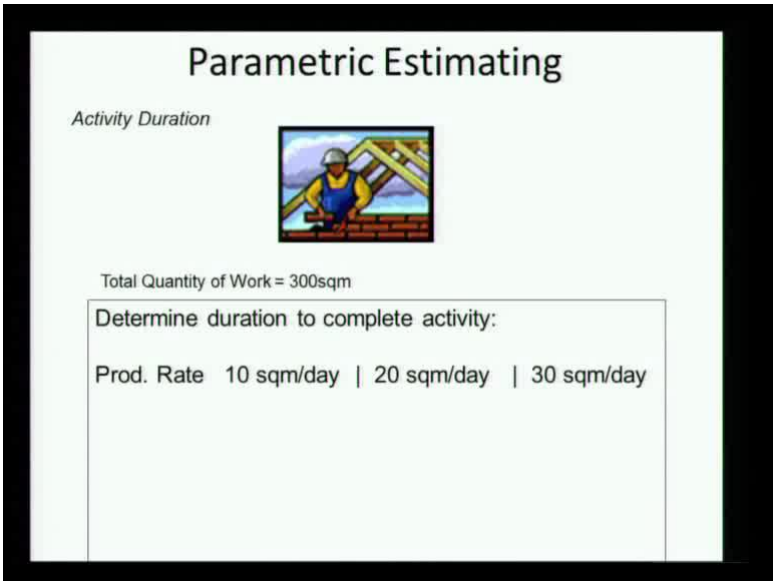

So, now taking this analogy to construction context, here is an activity; it is a masonry activity. The total quantity of work; let us say 300 square meters of block work. What would be the time required to compute that? How would I estimate? What do I need to estimate the time?

Student: Number of man-hours.

A number of man-hours is yes. So, I need the equivalent of my speed; there is something here; it is my rate. It is again a speed; the speed with which I am laying bricks. So, if we go into this, I am calling a production rate; what do you call? Units are really this, you know, very similar. So, I have 10 square meters; it is 20 square meters; 30 square meters and if I am given this kind of data, what are my, how many days?

Student: 30, 15 and (refer time: 08:18)

That is very straightforward; very straight. Now, where do you think the challenge is?

Student: We cannot work the entire day.

We cannot work an entire day (refer time: 08:29) take a day we will see. I mean that is, when I say entire day, what is a day? Is it 24 hours; is it 10 hours; is it 12 hours is it 8 hour: that has

to be defined. In this case, let us say when we say day, and we have defined that.

Student: We are assuming you can work on all days continuously, at a stretch then weekends.. (refer time: 08:49)

So, I do not have a calendar here. We are able to say, when I say 30 days, it means 30 working days.

Student: Again, the rate need not be constant (refer time: 08:56)

Rate need not be constant. So, what is 30, what is 10 square meter a day mean?

Student: The skill of labor.

It is not just skilled; it is the average output for that crew or that person over the day, just over the day. It means in the morning; you might be slow; afternoon, it might be faster; evening might be slow; we do not know, but we are saying, and this is not just the end of one day. The average of productivity of the average output is so many square meters per day. I am using the word productivity; we will come to that a little bit later. So, the same question as in the speed, certainly, the production rate is not constant. Now, we can have a lot of things that affect the production rate, and we will get into that. We look at these; what are the things that affect the production rate?

Student: (refer time: 09:57).

So, fatigue.

Student: (refer time: 10:02)

Wait, let me go to the board and I think I write these down.

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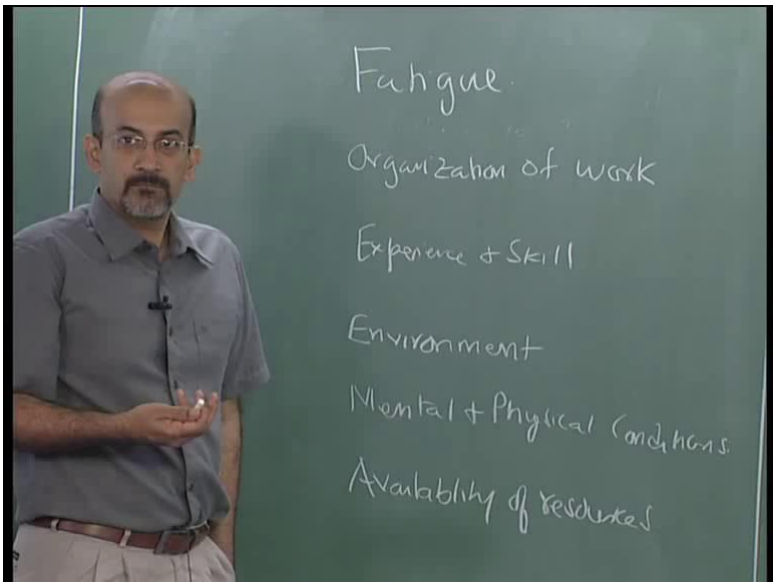

So, one is fatigue. What else?

Student: From the organization of tools and (refer time: 10:15)

Organization of work. Experience and skill, environment; I am putting environment; weather.

Student: Mental conditions, psychological.

Mental and physical conditions.

Student: Availability of resources.

Yes, very important, because the labor might be there; the workspace might be there; either the brick is not there; the motor is not there, or you know, the something to level my wall is not there whether, it is a plumber or leveler or whatever; then again, workers idle.

Student: Different parts of regarding post lunch, before lunch (refer time: 11:34)

Yes, those might be we can call it environmental factors; we can call it mental and physical conditions.

Student: Can it also be dependent on (refer time: 11:41) you have different types of advantages.

Organizational work. So, we can go on; there are certainly many more factors that they would come in, but what we are basically trying to highlight here is that there are serious of factors, which actually affect production. And given an average, when I am getting a new job, and I have to estimate what is production, you know, of my crew on the job; it is not that easier

task. There are so many factors which influence production and let us get; now, one thing we have not actually because being masonry, we have not discussed is, you know, what are the work factors; what are the materials? If I use block work versus bricks, what is my production? You know, if I am working at the height versus ground level, what is my production? So, the point I am trying to make is there is a just number of factors, which influence, which make some of this kind of estimating, a challenge.

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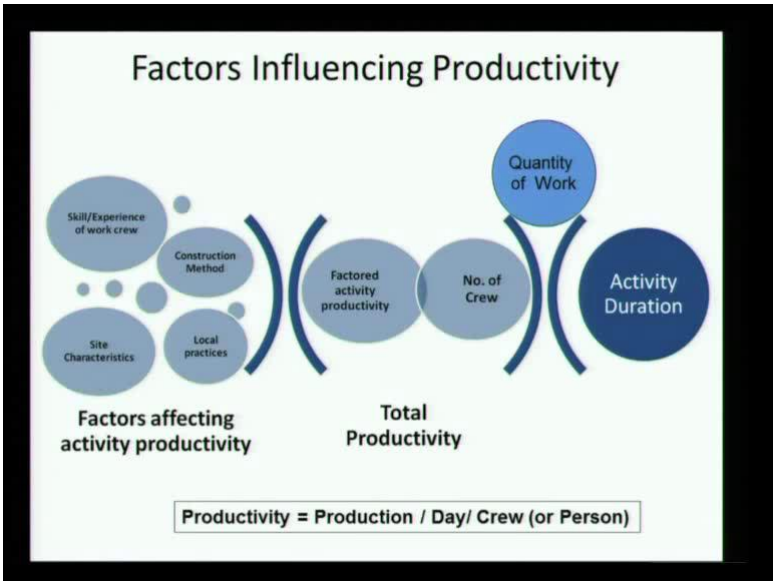

Yeah.

Student: The number of factors actually, fatigue to mental and physical conditions or relate to a person or a crew right, but the availability of resources is related to the project; it has to be provided by the company.

Right.

Student: So, that is the demarcation between, I mean a crew, its production rate and a company based production rate.

Yeah, but ultimately, what; mean all of it affects what?

Student: Productivity of labor; the output.

The productivity of the labor; it is all reflected Finally, in the labor productivity. The reason might be different, you know, we do not see much equipment usage here, and another thing is equipment maintenance and equipment breakdown. If the equipment breaks down what happens? You know, it is again, corporate level policy and you know, maintenance routines

and things like that, but it again affects the crew. So, actually productivity measurement and improvement in construction is a whole area on its own, and if we can take any of these factors and go into root causes and how to eliminate things like that, but as far as the context of this lecture is, we have to understand that this is the base on which, our estimate is built. If this, unless we can actually understand this, you know, be able to estimate what is the influence of this; we will really not be able to come out with a good duration estimate.