Introduction to Lean Construction
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What is Productivity, Production?; Illustration

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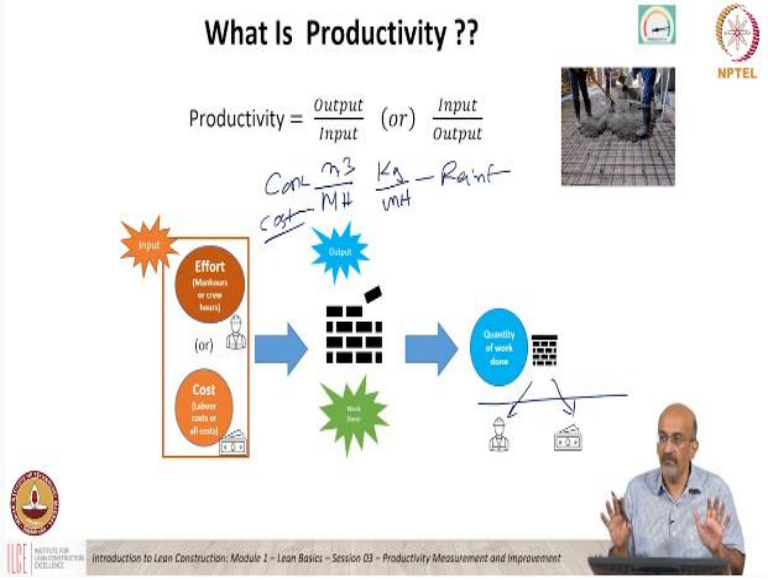

Now we come to this question what is productivity?

Student: Output by input.

Professor: Good output by input is a very what do you call, is the most acceptable definition and we say output by input, can it be input by output?

Student: It depends.

Professor: It depends, yes.

Student: It depends in many places.

Professor: It depends in many places around the world in construction, it can be either we I mean we tend to use output by input in our country mostly and mostly for civil works but input by output is also commonly used in the construction industry especially for mechanical works it is very commonly used piping and all of that.

So, we have to be careful when we talk about productivity, what are we actually which is the ratio we are looking at. So, when we take for example output by input that is what we

will continue with, so you can see a few an activity going on there that is concreting, what would be output here and what would be input? So, we are looking at concrete pored so you had mentioned certain kind of factors they were correct but can we be more precise concrete pored means what is a unit?

Student: Cubic meters.

Professor: Cubic meters of concrete poured and when we look at what, so that would be the output would be cubic meters of concrete, what would be the what would be the input?

Student: Manhours.

Professor: So, this would be meter cubed and manhours, that would be one potential measure that is output by input. Now we take reinforcement, you can see reinforcement, if I was doing reinforcement what would it be?

Student: Kg by manhour.

Professor: Yes, it could be Kg by manhour. Now, is there any other input or output I could think of for these two examples, this was concrete, this was reinforcement.

Student: Cost can also be there.

Professor: Cost can also be there. So, my output might still be the quantity depending on how I am choosing to measure, the input could be instead of manhour I could use cost and what cost could I use?

Student: Material cost as well as manhour.

Professor: Yes, I could use my labour cost or I could use my total cost, not just material labour, material all of the cost together, everything together. So, this is typically what we have, I am just reiterating what we discussed, so we can have input either in terms of manhours or crew hours, we will discuss when to use manhours when to use crew hours or in terms of cost it could be labor cost or it could be total cost. So, this is what is constituting the input.

Now, we have work that is done, so here we have example of masonary thing, this is output we know now its quantity of work that is done and we have quantity of work divided by either manhours or total cost or cost of manhours, all of these are variations in how productivity is measured on projects.

Once you standardize a measure you want to use for your project understand the benefits, the limitations and I mean these numbers can vary depending on assumptions made, many factors are there, productivities are we definitely use it as a reference but by no means is it like a universal value, there are many factors which influence these.

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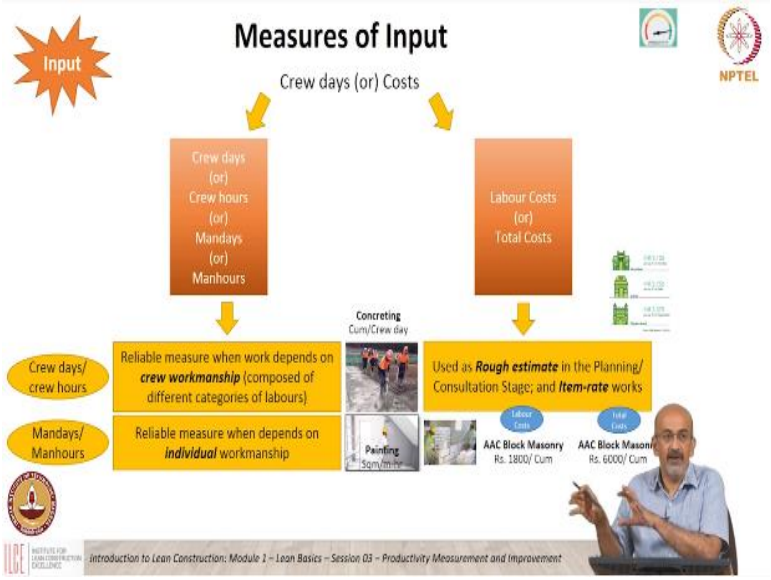

Now when we go into input again we talked about all of these variations, we had crew days, crew hours, mandays, manhours you have to decide all of these options are there and all we have labor cost and total cost. Now, you have to decide which element is which, how do you actually want to go about deciding the input and it makes a difference.

If for example you can see here if I am going to use mandays which means I am taking a crew and I am taking the individuals in the crew it would mean that almost each individual is contributing equally. If I am taking crew day, then I have got aggregated, I have aggregated the whole crew into, all the people into one crew and I am considering at

a crew level, that means there could be variation in the, there could be helper, there could be skilled person, there could be difference in the way it works.

So, if I use manday calculation for a very heterogeneous crew, you will have problems with the way its being measured, whereas if I have a homogeneous crew and then I use mandays it is more reasonable because then everyone's output is in proportion or I can use cost, where might be my helper gets less and my skill person gets more and in which case might be my cost basis is okay.

So, when we go into the whole issue of how do I choose my input, one has to understand the inputs I am choosing to measure my productivity in my site and the limitations and any assumptions that are made in it. So, the choice between which system is used on your site, so a lot of times we might not have a choice of which system we can use, we might be having a system in place but do understand what it actually measures, are there any doubts or questions at this stage.

Between choosing cost was between the labour cost or total cost or let me say how would we decide between choosing labour cost or total cost?, which would I use to measure productivity?, if I had an option between the two what would be my decision point?

Student: It depends on like if whether it is only a single activity or there a different chain of activities.

Professor: So, assuming even if its a single activity, I would look at it this way to do total cost my measurements have to be more precise, I need more effort to estimate total cost, whereas labor cost is a simpler calculation.

Now if I am using productivity to control my project or control my progress and what we have need we are using it for monitoring and control I would go with labour cost because I can use the numbers readily available for me as an input to understand my productivity calculation.

If I am trying to do an overall accounting process and I really need to get into the nitty-gritty details, then the effort to calculating total cost is required and ultimately many projects will use total cost for the accounting purpose, but I might use labor cost because

I need weekly measurement of productivity and I might just use it for as an interim measure then why use labour cost I might just use labour hours, crew hours or manhours which is even more of a broader measure, I do not need to worry about cost.

I am just, so I could control my weekly or monthly or bi-weekly progress with just this measure of using crew days, crew hours or mandays, if I want more precise information on the project as I go forward and not necessarily monitoring and controlling, I would go with the cost.

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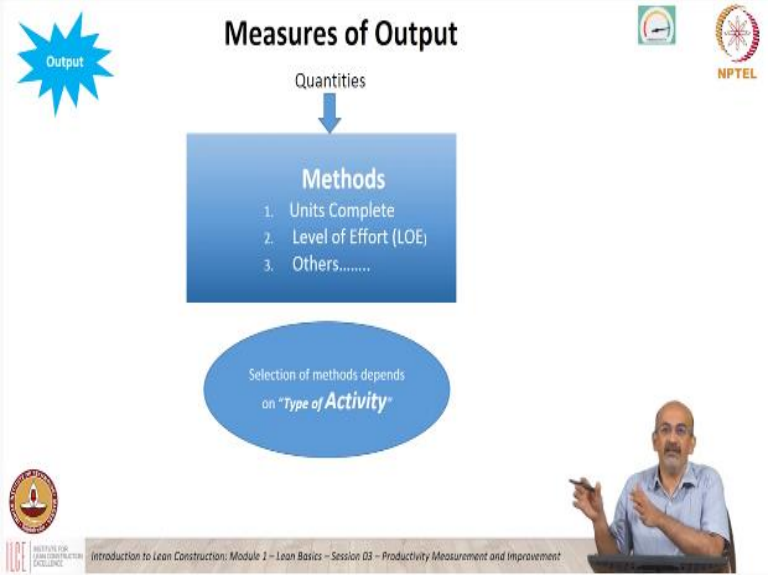

We go to outputs now, we will cover this in more detail in the next section when we go. We have different methods in which outputs can be calculated and this again becomes important. So, if I use units complete for an activity which has many subtasks, I will not get a correct output measure and my productivity value will seem incorrect and will not correlate with what is actually happening outside.

So here again we have to understand what the issues are and select the method appropriately based on type of activity but like I said we will cover this in more detail in the next lecture.

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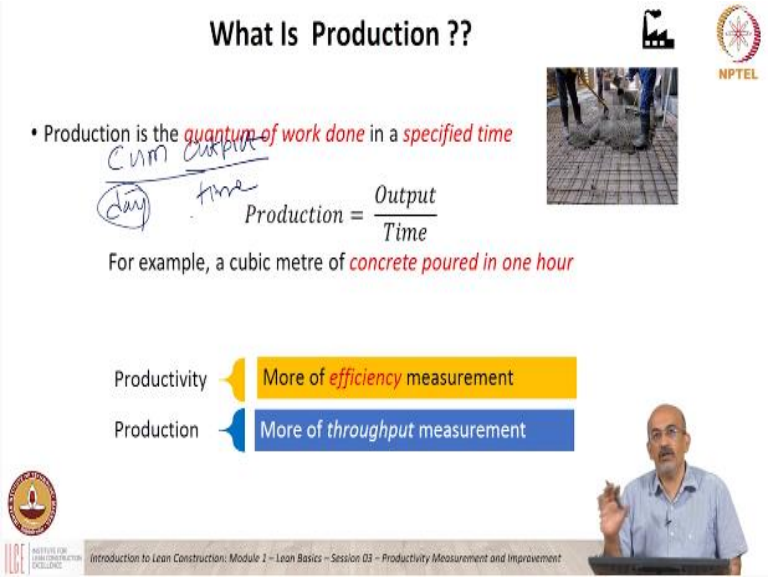

Now we come to this next question, so once we decided we discussed right in the beginning that we will discuss what is productivity and what is production. So, now we come to this term production, what is production?

Student: It is an output unit what you are producing out of the like, what you can bill or…

Professor: What you can bill, that is correct so again we come to this example here you have concrete being poured, what is, there we talked about productivity, in this context how would you, what would we say is production?

Student: It would be work completed.

Professor: Work completed, anything else?

Student: How many cubic meters of which grade of concrete is there.

Professor: Right, how many cubic meters, so you are saying this is something cubic meters of concrete or meter cube divided by?

Student: Over a period of time.

Professor: So, I will need per day say, production is I mean or a month or a week. So, it is not just meter cubed, when you say how much I can build that might be by the end of the

month. So, there is a time element but how is this time element different from what we saw earlier, earlier was manday or crew day or manhours what is the difference?

Student: Sir, manday and crew day are actually what the people are actually working only the working time, where day is normally calendar day.

Professor: Right, so this is a day without measuring effort, this is only measuring time as a flowing entity, it is not measuring the effort that went in. So, this is not really input so we are measuring only output over almost like time and it is not a time effort based.

So, basically you can see production is a quantum of work done in a specified time, so it is just output by time, so it could be cubic meters of concrete poured in one hour, it could be concrete poured over a day, it could be a month but the main unit there is the cubic meters and the time unit comes.

Student: Then sir this production is more or less related to the overall activity not only to the sub activities.

Professor: I could take concreting.

Student: But concreting, so I can take this particular 1000 cubic meter has been poured in a day, one day, that means overall concreting but sub activities of the concreting part those will not come under production, there is a sub part only, we cannot calculate that.

Professor: Right, but my productivity also requires, so to pour this quantity I need that all the sub activities also as far as productivity goes.

Student: That is true.

Professor: So that way they are in a in a similar kind of process. So, when we look at when we look at productivity and production you can see that productivity looks at efficiency and production looks at throughput. Now which is more important?

Student: Both.

Professor: Both are important, okay so we cannot say oh productivity is this course has deals with productivity in a way so productivity is more important than production or you know actually on our sites which one do we measure more frequently?

Student: Production.

Professor: Production, we measure production more frequently, so we cannot say, no production is important productivity is not important, both are important.

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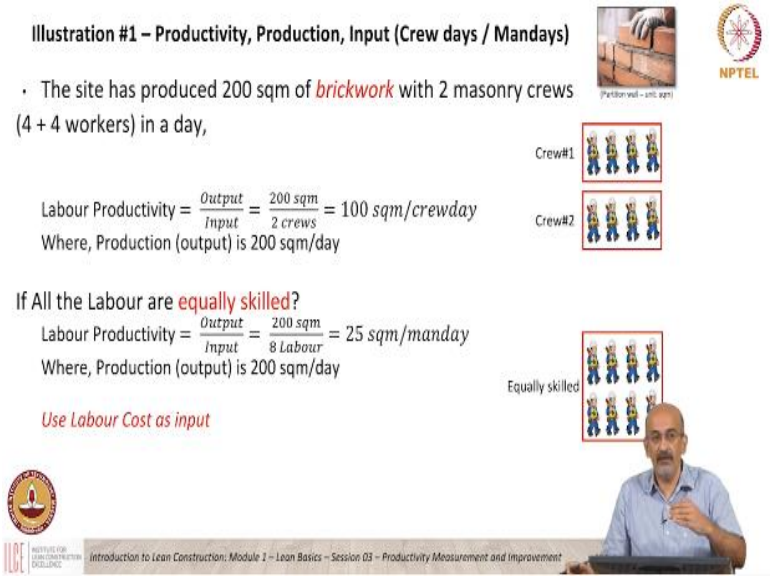

So in this part, so just again I think this is a fairly simple example to show you, illustrate what each means, so just take a look at this, you have a site that has produced 200 square meters of brickwork with 2 masonry crew, so what is the production?

Student: Production is 200.

Professor: 200, so production will be 200 and what is the productivity?

Student: It depends.

Professor: It depends on how you choose to measure, if you choose to measure by crew then it is 100 squared per crew day, if you choose to measure by manday?

Student: Then it will be divided by 8.

Professor: Yes, you will have to divide it by 8 and then you get 25 square meters per manday. The production remains the same because that is production. So, you can see that how, I mean this so how the units play a big role in this whole process. Now instead of using crew or manday or crew day or manday, I could multi use the cost that I incurred

for the labour, so that would give me so many square meters per rupee and that could be the labour cost or it could be total cost and now again.

So, let us just take this why would I prefer labor cost rather than total cost, one we discussed it is simpler to calculate labour cost or simpler to do labour rather because other one requires a few more steps of calculation, what would be another thought in why I would prefer to do it based on labor alone and this is for monitoring purpose not for final calculation or final profitability, why would I prefer labor, any thoughts?

So if I look at variability, if labour is idle, I mean assuming that we are paying him a daily wage, we are not actually getting work for that period of time the person is idle but we are still payment is made, my material as inventory cost is still important but if I track labor I will be able to get a good idea if there is a lot of inefficiency in my labour usage, there will be I can start taking steps towards improving my, identifying where the problems in my site are or problems in that activity.

So, labour is kind of like your litmus test, it tells you initially where is the issue, I can start off with that, if I start measuring more complex kind of parameters it might it will be more difficult to start.

Student: Plus it will be time taking.

Professor: It will be time taking, exactly, more effort, more there is more calculation but if I can get the same result with a simpler step and simpler calculation let us get started, that is why globally labour is used as the input, labour hours is used as the input because in general it gives you a much better, easier way to understand what is happening on your project, this does not mean, we will discuss this later there are other ways also.

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