Introduction to Lean Construction
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Module 1 Lecture 06
Productivity and Production Calculations: daily, weekly, cumulative

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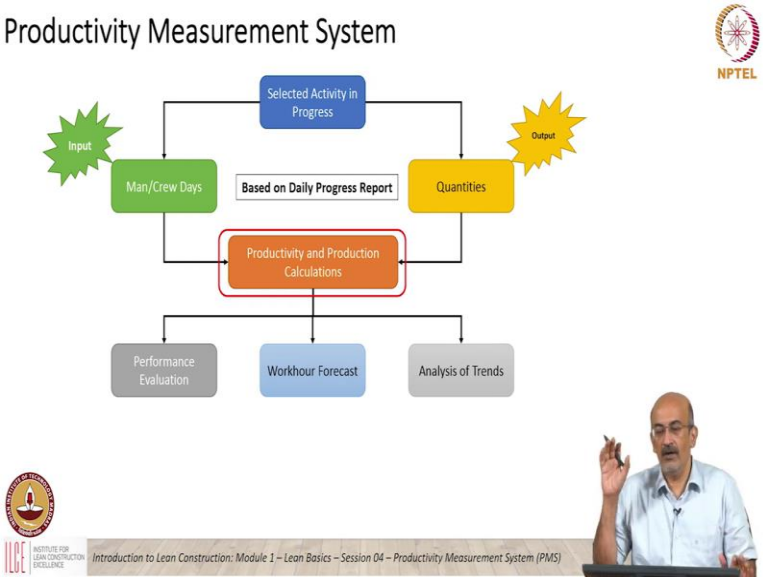

Professor: Now, we are going to productivity and production calculations based on these two, the inputs from the labor hours on the quantities.

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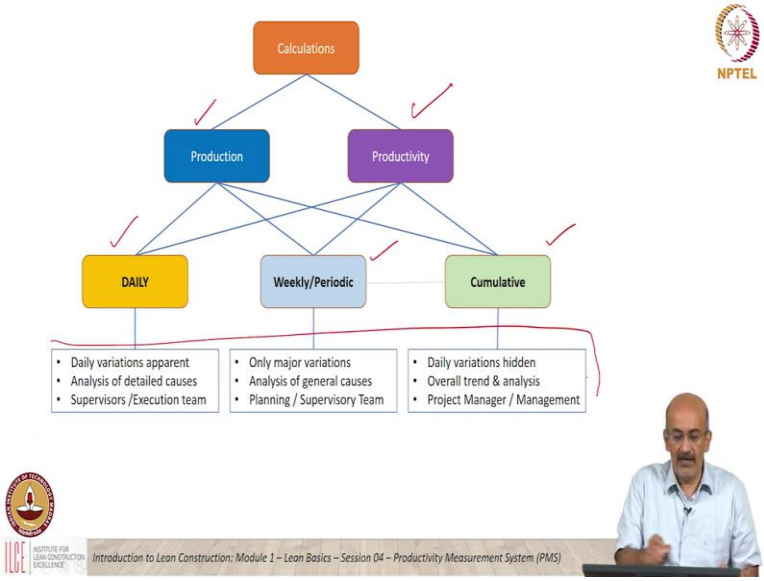

Professor: So, when we go into these calculations, we have a lot of options. So, these calculations can show, like we discussed in the last class, there is production and productivity, and this can be done on a daily, weekly/ periodic or cumulative basis.

So, what we are going to do in this section is to be able to discuss how these calculations are converted into daily, weekly and cumulative reports and what these reports mean, and we will come to basically understanding what is here in the text after we look at the different reporting formats.

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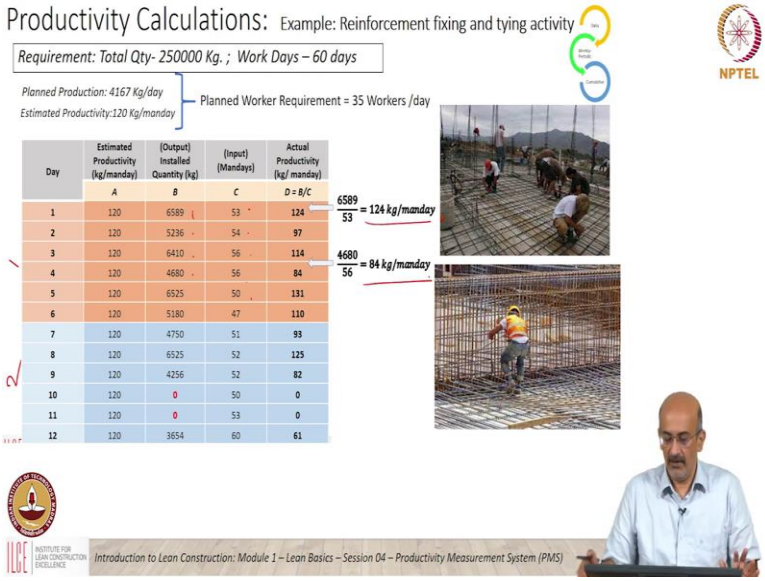

Day	Estimated Productivity (kg/manday)	(Output) Installed Quantity (kg)	(Input) (Mandays)	Actual Productivity (kg/ manday)
	A	B	C	D = B/C
1	120	6589	53	124
2	120	5236	54	97
3	120	6410	56	114
4	120	4680	56	84
5	120	6525	50	131
6	120	5180	47	110
7	120	4750	51	93
8	120	6525	52	125
9	120	4256	52	82
10	120	0	50	0
11	120	0	53	0
12	120	3654	60	61

Professor: So, let us take an example. So, this will be an example of a reinforcement activity and the total requirement is shown here, 250,000 kg in 60 workdays. This translates into a planned production of 6147 kg a day and an estimated productivity of, and the estimated productivity for this 120 kg per man day. Now, so this translates to a planned worker requirement of 35 workers per day. So, this is the overall plan or the overall macro level view.

As we go into the details of daily requirements, you will find, we will see that here we have a 6-day work week. So, what this table shows you is the day of the week, 6-day work week running continuously. So, this is Week 1 and this is Week 2. The estimated productivity as given there is, is the same for all days. We are taking it at, at one level.

What this shows you is the quantity installed. On each day what was the actual output. And this is the input, shows you what the input was, how many man days were spent on each day and the calculation of productivity is shown here. So, basically you can see that this is basically the productivity calculated on each of these days. So, the table is fairly simple, and the calculations are fairly simple.

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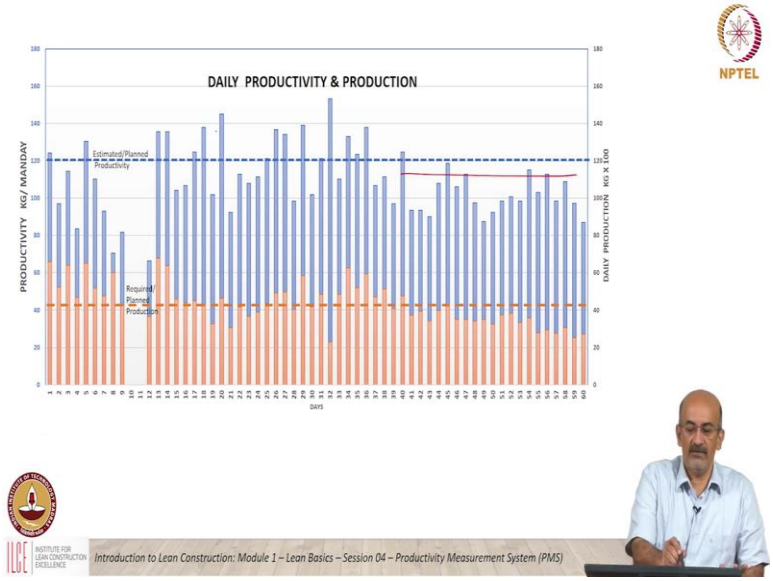

Professor: Now, we can translate. So, in the supplementary material you have the full 60 days in a spreadsheet, and you should be able to analyze that and use that. But when we cover the 60 days into a daily productivity and production graph, this is what we get. So, take a few minutes to look at this graph and let us take, let us try to discuss some of the salient points of the graph. So, you can see the graph. So, you can see the two dotted lines. What do the dotted lines indicate?

Student: The estimated…

Professor: The estimated values or what we know, what we need. One is the, for the productivity and others for the production. The blue indicates the productivity level, the pink or red indicates the production level. What is your general comment on productivity and, on productivity first, from a daily perspective?

Student: Lot of variation.

Professor: There is a lot of variation. That may be expected from a daily graph. Can we make any judgment on is it okay or not okay?

Student: In the production, you can say it is more or less…

Professor: Yeah, when we just look at it visually, the production seems to be more over the graph, so we are visually saying it is generally ok. The productivity, we are not, mostly if you take it seems to be below, especially in this sector it is definitely below. Somewhere here, some days the productivity is higher.

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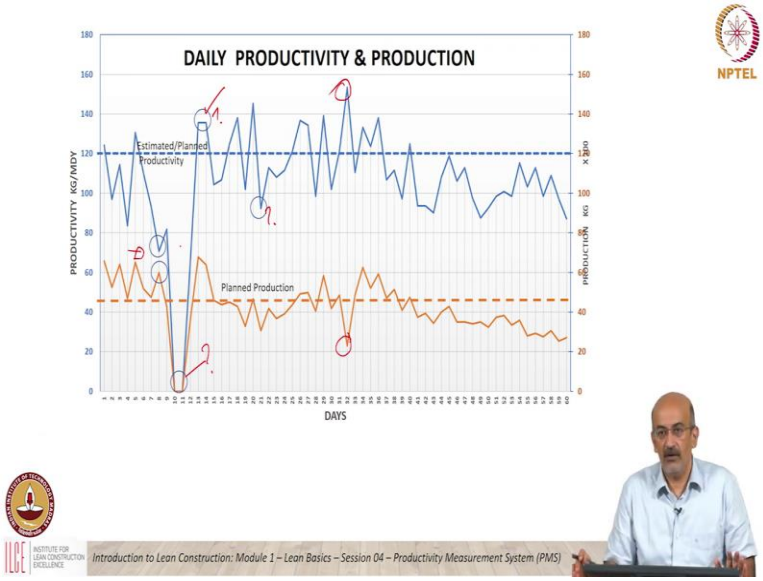

Professor: I am translating, converting this graph into basically the same data, it is just shown in a line form. And so, you can see there are some peaks and…

Student: Similar trends, sir. Yeah.

Professor: Some peaks and some…

Student: Similar trending productivity or…

Professor: That is a, that is an interesting question. Is it a similar trend in productivity and production? Take a look. We discussed this last time.

Student: If we look at day number 32, where…

Professor: So, yeah, so if I look, so, the question is, is the productivity and production trend similar? We had asked this question last time also. They, in general, they might be

similar if the crew size is roughly the same, but if there are disruptions, they need not be similar, as it is illustrated here. Here production takes a dip, productivity is at peak. What do you think is the pattern here? Why do you think this happened?

Most likely, the crew numbers could have reduced. So, production reduced but the productivity is still high. The output that crew put for that is high. Now, any other patterns? So, here is another thing I would want to do. I would want to ask what happened here?

Student: Sir the production is low, that is why…

Professor: Something else happened. If I go back to the table, I will see 0, 0 output. Might be, it is weather, might be material run out, it might be, so the planning team, so I am not looking at 60 days of data during my, I mean during a regular weekly or daily meeting, but if I was meeting on this day, I would ask what happened here and try to do corrective action for this. I would want to know what did I do right here, to make the production go up.

Might be here, the material was not available, suddenly all the material became available, and I could I did not have any material shortage, my production was good. It could be. So, I would want to know what happened. Again, there is a dip here. I would want to know what happened here. Now, what are, what do these circles indicate? What does, why do I, why did I highlight this?

Student: The production is going up and the…

Professor: Yeah so it is a reverse of what happened here. Here the production increased, but productivity decreased. What would be the situation in which a production increases and productivity decreases?

Student: Production, if we took more resources.

Professor: More resources. It is a normal problem. We put more resources, the production goes up, but the productivity need not necessarily go on. So, your weekly graph of productivity gives you an insight into all the variations. There are questions to be asked. They should be, you should understand why certain patterns occurred. Of course, you are

not seeing it over a 60-day period like, this but you are seeing it in, in weekly segments or once in four, five-day segments to be able to ask and take corrective action on it.

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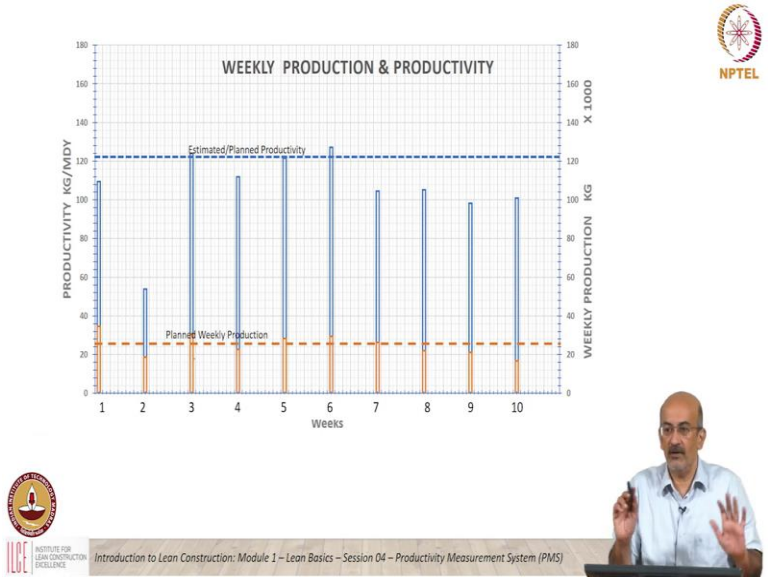

Professor: Now, this is the same data converted into a weekly production and productivity graph. So, you can see what is the first thing that stands out here?

Student: Production level. We can clearly see that it is more or less getting stabilized.

Professor: Production level because on a week-to-week basis it is more or less stabilized, okay.

Student: There is less fluctuation in the productivity also.

Professor: Correct. There is, yeah, because we have all these daily fluctuations have been now absorbed into the weekly side. So, the variations are less, which means my information on details have reduced but my, if I am looking from a weekly perspective, it is visible what is happening, I mean weekly control. So, this is ball by ball over, ball by ball run rate kind of measurement this is over based run rate measurement.

And again, some things come out. So, on a weekly basis I only had two weeks where I, my productivity was more than my planned, whereas my production, some days it was less, some days it was, some weeks it was less, some weeks it was more, I am still kind of looking at it.

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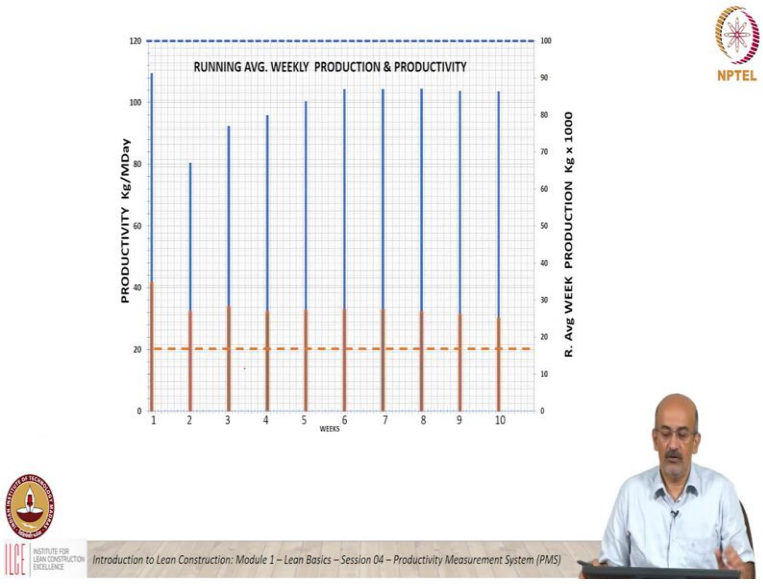

Professor: So, now, I go to another graph now. This is, I am taking almost the weekly average in a running form. That is, for every week I am calculating it continuously. So, for Week 1, the whatever production on Week 1 was 40, the Week 1's production is also factored into Week 2. Week 1 and 2 are factored into Week 3. Week 1, 2 and 3 are factored into Week 4, production and productivity. Now, what do you, when you look at this graph, what can you make out of this?

Student: It is more stable because it is continuously…

Professor: It is more stable because there is a lot more data as you go week to week. So, it is very difficult, so one week of up and down will not change it. What would be your interpretation of this, what does this graph tell you, overall, from the project perspective?

Student: Performance over the period.

Professor: It is, so when I compare, this gave you week by week. Here, each week's data is independent. Here each week's data is dependent on all the previous data. Correct. That is but now when I compare this and this, one thing stands out. What is it?

Student: Production. We can see that the level of production is more than planned.

Professor: It is more than planned, whereas level of productivity?

Student: Always less.

Professor: Always less. So, if you go back here, this fact, the fact that this, here you can see productivity was close to 120 but whenever the, whatever did, this pulled it down, really pulled the productivity down, and it really never recovered. Even though this went above, all of these are below. So, the productivity never recovered to reach 120.

If I go to production, here also production was below, but this production was above. Correct? So, these two kinds of compensated, and all the time, even though it goes below, the productions above in the prior has always compensated. So, it has continued to remain above.

So, from a project perspective, I am not looking only at week-to-week performance, I am starting to look at my past performance also, up to now, which gives me an indication as to whether I should, what kind of control action should I take.

So, for example here you can see production has been consistently below the asking requirement, but the project team is not worried because they know, if you look at this, they know that it is, so you can see it is declining here. Even though it is declining, the past production, so it is I scored all my runs in the first 10 overs. So, I do not need to worry, the remaining 10 can be taken in a, in a easier fashion. I do not have to, when you look at this, you are worrying only over to over to over. You are not looking at the bigger picture. So, this really gives you the bigger picture.

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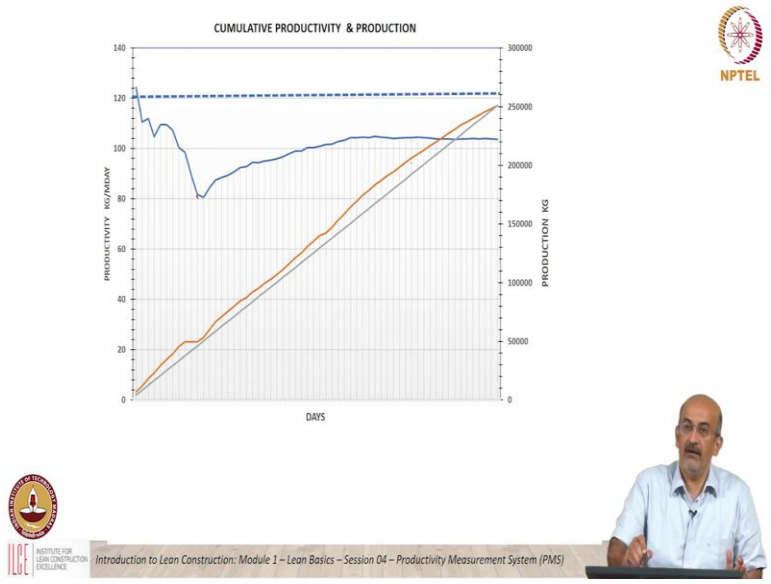

Professor: Now, from a much more broader perspective this is cumulative production and productivity if I am just looking at it from a cumulative perspective. I am taking it cumulating it on a daily basis. This is the graph. So, you can see the productivity drops, this is where the, the big drop in productivity, and it really never recovers. Production, there is a dip here but it has always kept above the…

Student: The planned.

Professor: The required rate.

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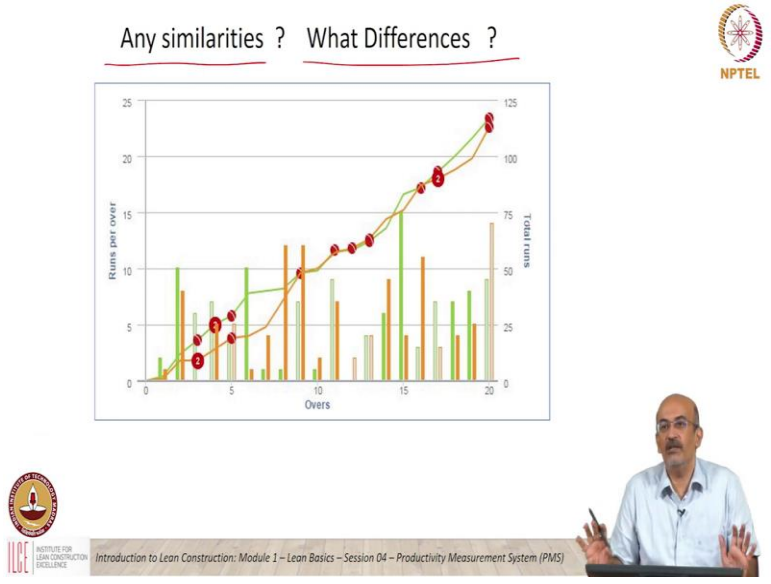

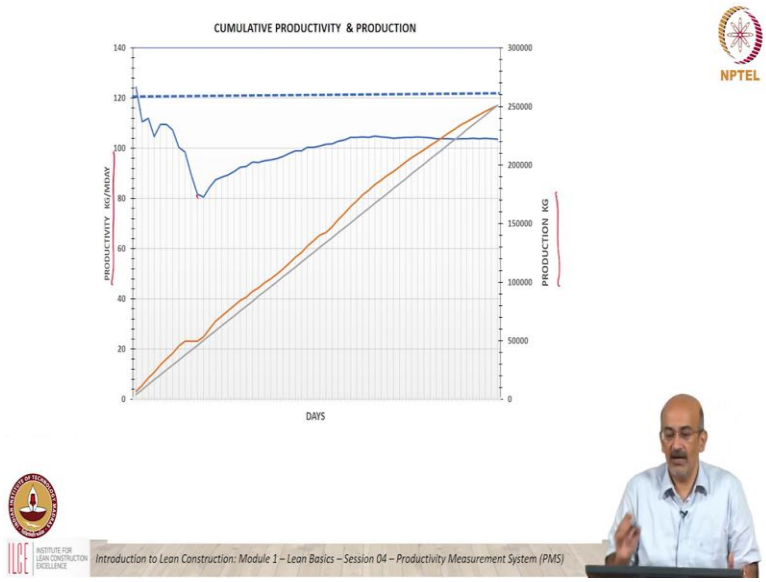

Professor: So, we can discuss cricket and our productivity requirements, because you can see the graphs are very, very close, very closely resembling each other, and this is something for future discussion. We can look at what are the similarities, what are the differences. Here, we have for example total runs, runs per over, all of these, there are a lot of, lot of things which we track in cricket which is like tracking a project.

So, I just want to bring about that here, so on this graph we have, on this axis we have productivity, this axis we have production. So, I did not highlight that earlier but in all of the graphs that is the way it is represented.

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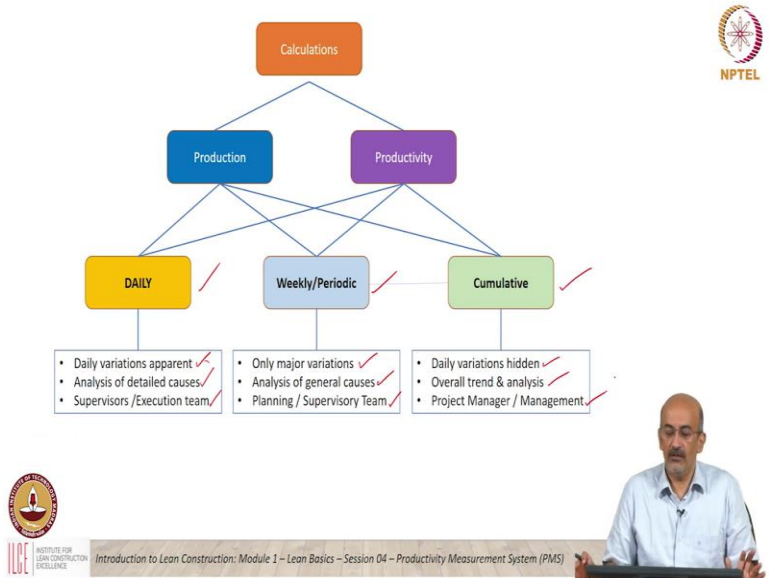

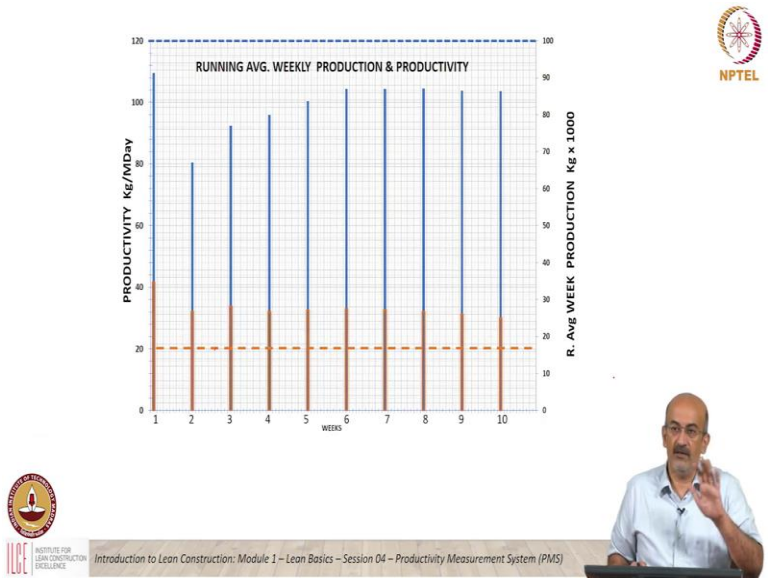

Professor: So, now, we come back. We looked at all these calculations. We looked at daily, we looked at weekly, we looked at the cumulative, and we kind of drew some of these conclusions as we looked at the graphs. One is, in daily the variations are apparent. For weekly, only major variations came up. When we looked at cumulative, daily variations are hidden and we could only see overall trends and the analysis that was required.

Daily allows us to use, allows us to get, to view the data and analyze detailed causes. There was rain, there was material shortage, there was crew interference, tower crane was not available. I do not know, you, we have been able to find really reasons at a daily basis.

In the weekly, that gets hidden. And only general major causes which cause weekly level disruption, we can find. And it is the same thing for cumulative. There is, all that gets hidden. Only overall trends can be found. So, when we look at who uses it, in a daily graph, probably supervisor, execution team will be using it, planning or the supervisory team will use the weekly, and project management or management team will use the cumulative.

So, the use of these graphs, so I have seen several places where the productivity measurement system is, or is done or the daily reporting is done but everything remains as numbers. These graphs are not produced. And I think it makes a big difference when

the feedback is visual. And it, with today's technology it does not take much effort to make this a visual feedback.

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