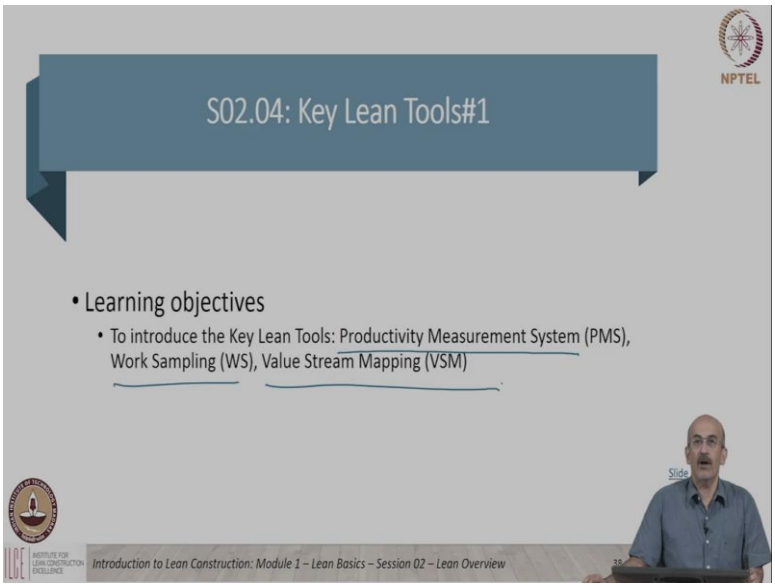
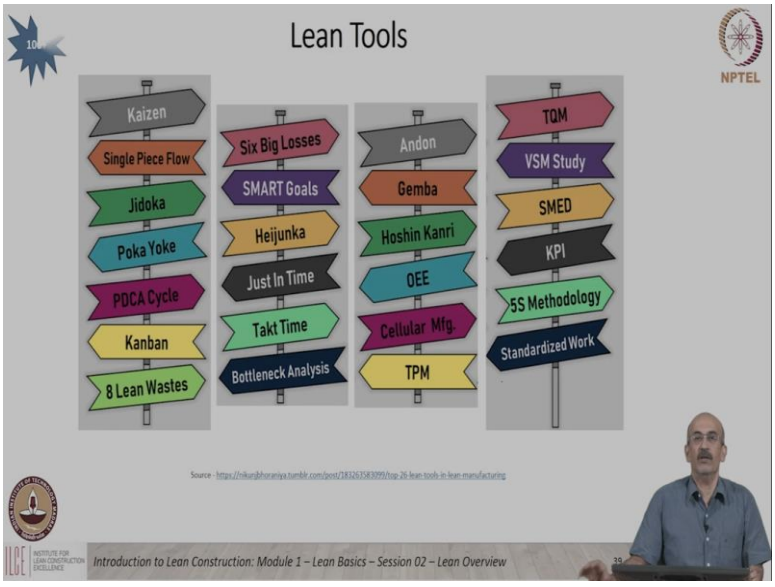
Introduction to Lean Construction (Module 1)
Professor. Koshy Varghese
Department of Civil Engineering
Indian Institute of Technology, Madras
Key Lean Tools#1
(Productivity Measurement System, Work Sampling, Value Stream Mapping)

(Refer Slide Time: 00:21)



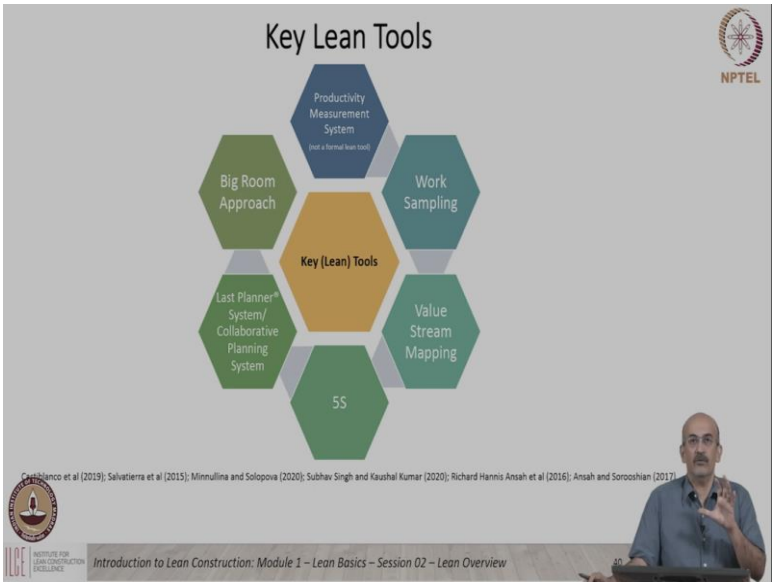


Now, coming to this topic of Lean tools, there are several Lean tools. In fact, there are hundreds of Lean tools that have been used and people have found benefit in it and it is always a challenge to see, which tool is applicable for the projects which I am working on and how to go about it.

Now, we have tried to apply several tools over the last many years to our projects and based on our learnings, we are kind of focused on a few tools which we thought brought the most

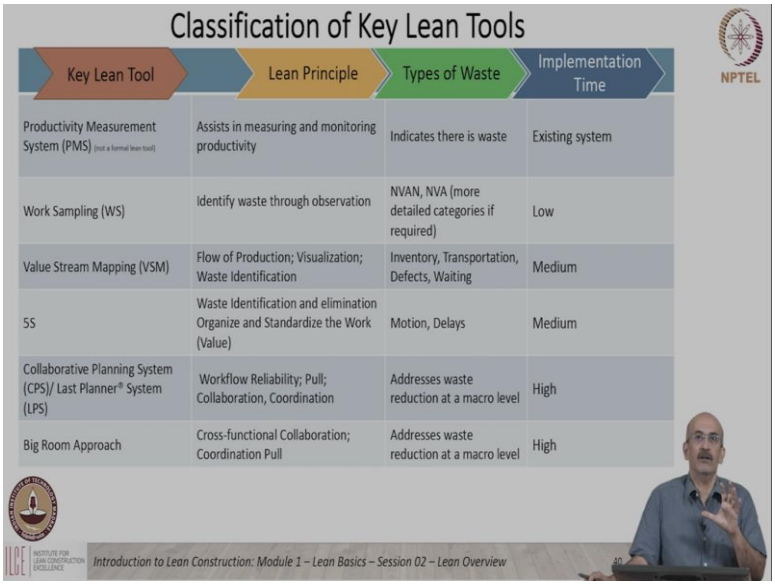
benefits or not only specifically the benefits, was a good way to start implementing Lean, to start getting the idea of Lean.

(Refer Slide Time: 00:57)



So, the tools which we are covering in this module are Productivity Measurement Systems, Work Sampling, Value Stream Mapping, 5S, the Last Planner and the Big Room Approach.

(Refer Slide Time: 01:16)



Now, these are the tools which we would like to give you a little bit of introduction on these tools in this session. If we go into the classification of these Lean tools and we look at it from which are the principles they address and what type of waste to the address and kind of ease of implementation.

We take a productivity measurement system. As I mentioned, it is definitely not a formal Lean tool, it is not a Lean tool in the context of Lean. But we cover it because it is a very basic tool in a construction project. It is used to measure and monitor productivity. And ultimately all the benefits of Lean should manifest itself in an improvement in productivity.

So, in many ways, a productivity measurement system is a basic system that needs to be in place. And while it does not measure or indicate any type of waste, it definitely indicates there is waste, if your productivity is lower. And it is an existing system. So, we have to make better use of these systems. Now, when we go into Work Sampling, it is a tool that we can identify wastes through observation. We are able to identify wastes, the broad categories are non-value added but necessary and non-value added.

But, if we go into more detailed categories, we can look at idle, we can look at transport, we can look at other categories of waste also through observation. So, work sampling in general, it does not take much time to train someone to do at sampling and to bring data back and for us to identify, what is the actual visible waste on a site. But, definitely does not look at inventory and other kinds of wastes, which also are very important.

When we look at Value Stream Mapping, it looks at flow of production, it looks, we can visualize the process; we can identify wastes such as inventory, excess transport, defects, all of that, through Value Stream Mapping with appropriate measurements of, which is done in the process. And it takes a certain amount of effort and time to be able to implement it. It takes training. It takes discussion. So, VSM takes a little bit out of effort to implement.

Similarly, with the 5S. By having your site organized extremely well, you are eliminating a lot of motions and delays. And we are able to standardize many things. We are able to actually waste time in searching for things or to arrange things, because they are all standardized.

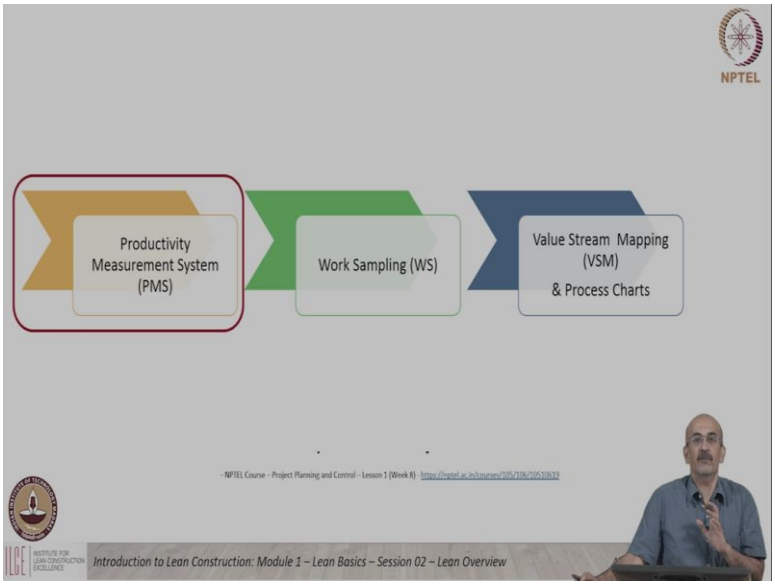
Definitely it adds a lot of value, to what how the work is done, but requires a system and will take probably a medium level of effort is what we are indicated. These values on implementation time is based on what we have experienced with different implementations we have done.

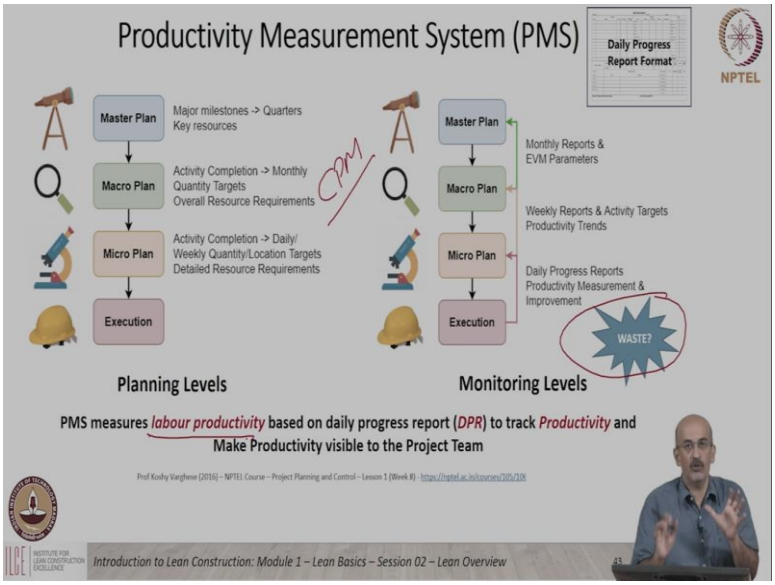
Now, when you go into the Collaborative Planning or the Last Planner System or the Big Room Approach, these are kind of larger system based approaches, which address a lot of issues. They look at both collaboration, they look at reliability, they look at establishing pull,

so they address the Lean principles in a far more broader sense, in a more macro sense and while they do not address any specific wastes, in many wastes, they address several types of wastes at a macro level.

It also addresses the people side of Lean. So, many things are addressed by these two systems, and because there is a lot more participation a lot more stakeholders in this, definitely the implementation effort or time is higher. But the benefits can also be equally higher, if they are implemented properly.

(Refer Slide Time: 05:04)





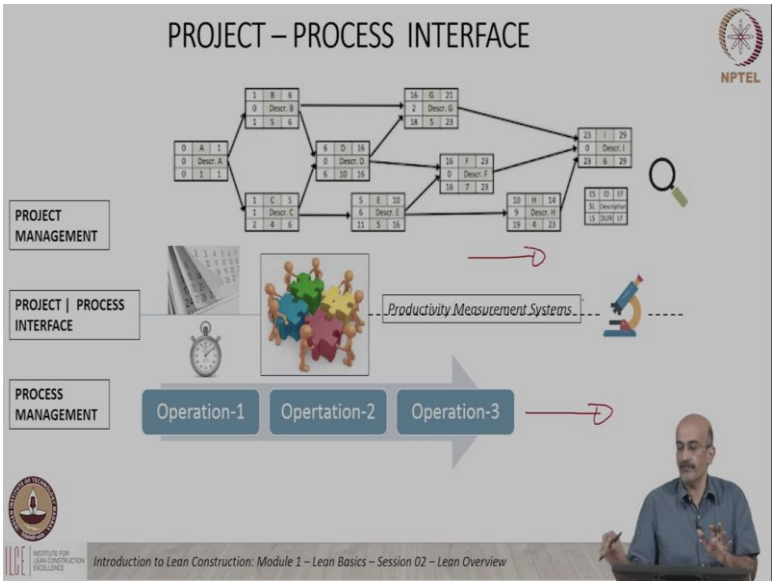
Now, I would like to cover a little bit about the specific tools, when you go into productivity measurement systems first. We are aware of these classic way of, where we have the project

management system, where we have the master plan, the macro plan, micro plan and the execution team. And then we have the monitoring system which goes back.

So, typically our CPM falls in this category of, how we do our classic project planning, monitoring and control systems. Now, where we look for Lean at a detail level is at the execution. And we look at how does, so, what we do here, is definitely based on things like the DPR.

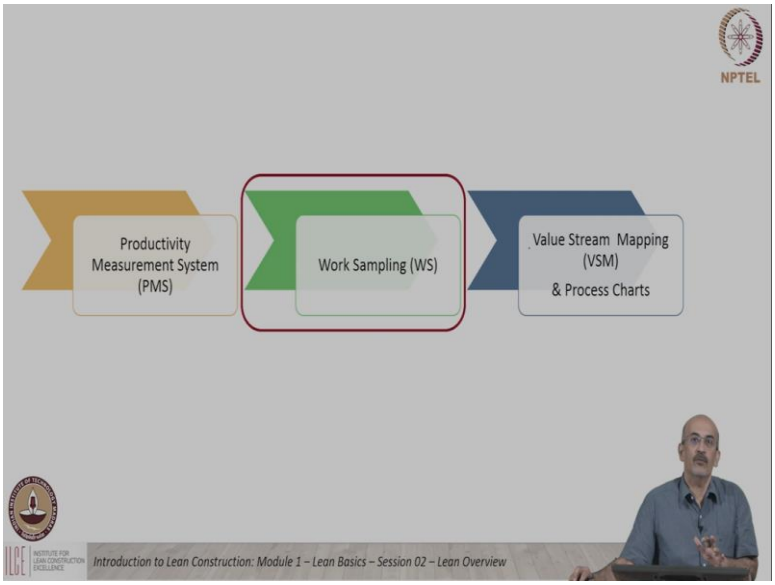
And when we look at a productivity measurement system, we are measuring labor productivity and we are trying to improve labor productivity, not only at an activity level but also at a work package or at a project level. So, if we are not just looking at labor productivity from an activity level, we have to realize that. It should be at a more macro level.

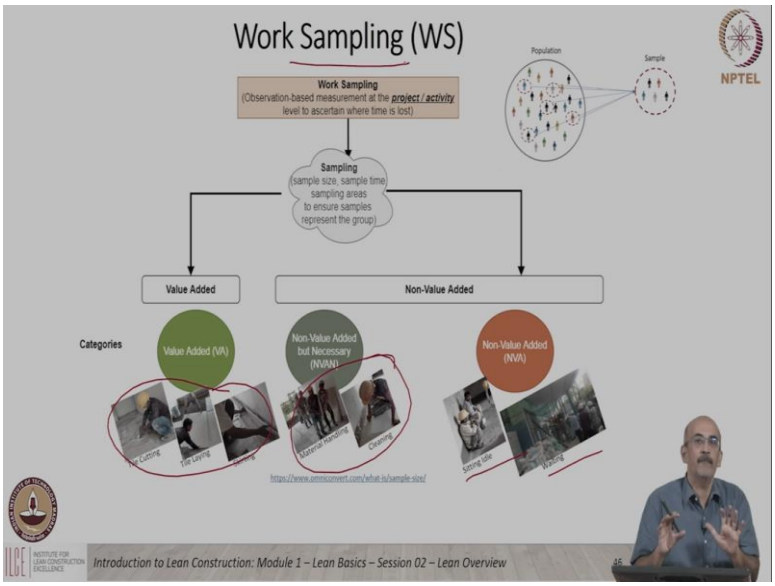
(Refer Slide Time: 06:18)



Now, when we look at the interfaces, so, we talk about the productivity measurement being as interface between what we call process management here and project management here. And this interface tends to be very important and how we fine-tune it and how we use our Lean tools to be able to integrate with the project requirements with the project management requirements becomes very very key to the successful implementation.

(Refer Slide Time: 06:48)





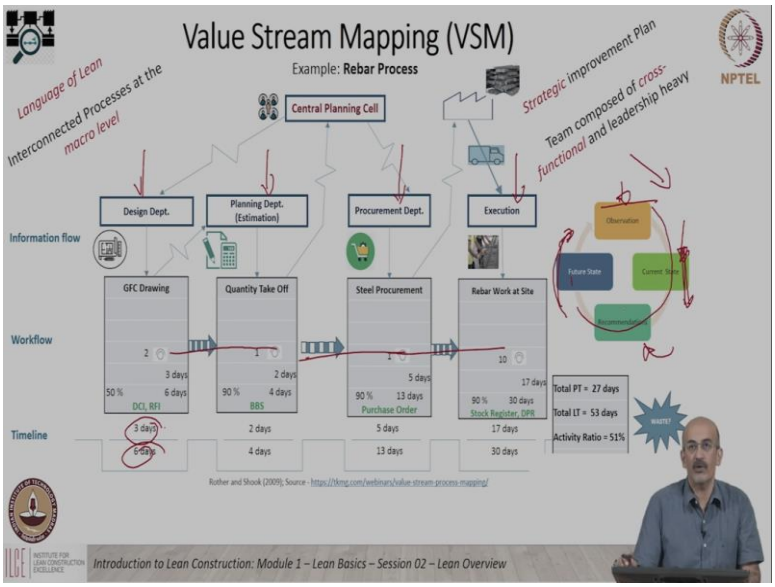
Now, when we look at work sampling like I mentioned, it is an observation-based technique and basically we are looking at value added, non-value added and non-value added necessary, trying to classify the activities in site, broadly based on this. But, more detail classification is also possible and is also done. When you are looking at value added here, for example, we are looking at actual work that is being done directly onto the work phase, value added.

Non-value added but necessary could be material handling cleaning, etcetera. And absolutely, when we say non-value added is sitting idle or waiting or taking a break is just non-value added. So, this would also give us a feel of what is the kind of waste on my site and as I mentioned it is an in a preliminary tool that gives an idea of that there is actually waste on my

site. This is what we have found that several project managers find when they use work sampling; they are able to estimate and get a numerical value.

Now, we will cover work sampling in detail in a subsequent session, but ultimately, like the term ‘sampling’ means it is based on statistical sampling, and we will cover the requirements, what level of statistics is required for our site based approach to work sampling.

(Refer Slide Time: 08:15)



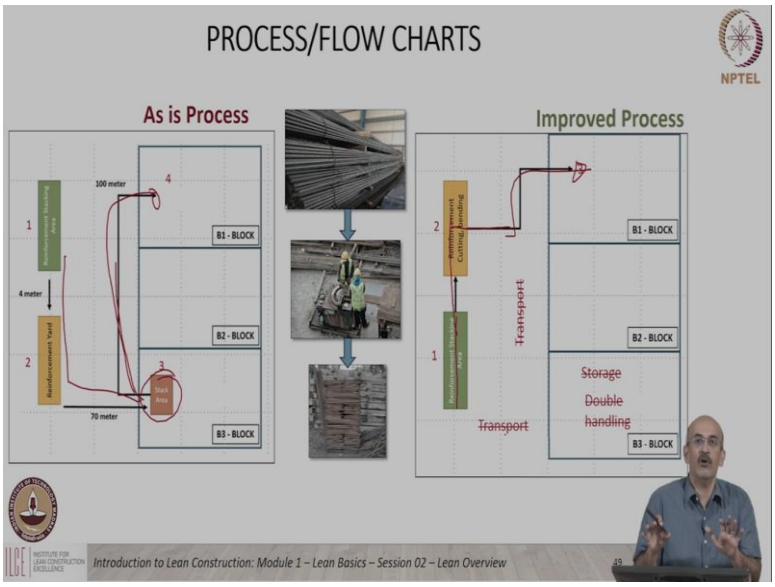
When we go move to Value Stream Mapping, this is where you can see the example of a Value Stream Map here. This is value stream map of a Rebar Process, where you have the design; you have planning or estimation, procurement and then execution. And how the information flows between these sections and how the actual work flows from the drawing to quantity takeoff to procurement to rebar work at site.

So, I am not going to get into details of this Value Stream Map, but once you map processes like this, you can add, you can put the actual time it requires to take the process versus the total time, which is your lead-time versus value added time. And then, you are able to actually look at the efficiency of this process, make changes to this and be able to eliminate waste and make the process more efficient.

So, this is another tool which will be covering in detail in this session. To develop a value stream map, as it is shown here, there are these four phases. One is you do observation of the process, you develop the current state map, make recommendations and then you do a future state map. So, this development of this value stream map, we have only reached the current state.

Now, we need to make recommendations on this to improve the efficiency, decrease the waste and that will be the future state map. Once we do the future state map, we can observe how the future state is implemented and then continuously go around this, to keep improving the process.

(Refer Slide Time: 09:55)



And finally moving to process and flow charts, if I take the same example of rebar yard, this is when we look at rebar, the final process, here is an ‘as is process’, where we will have reinforcement say, stacking here, reinforcement yard, it is, you can see, the movement of reinforcement goes this way, that is stacked here and then transported to be placed here.

Now, a process like this can be converted more efficiently into a process where you have the reinforcement stacking here, bending and cutting and then taking it straight for placement. So, we are eliminating a lot of the transport or double handling or storage required, again bringing in efficiency and process charts, generally look at the geographic distribution, transportation that happens and tries to improve the efficiencies by eliminating all of these extra things which are not adding value.

(Refer Slide Time: 10:50)