Toyota Production System
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Lecture - 25
Lean Manufacturing

Welcome friends, so far we have detailed discussions on various principles of Toyota production system and during those discussions, we use this term lean manufacturing very often and the idea of Toyota production system was basically based on identification of waste and elimination of those waste and that is the essence of lean manufacturing also. Now, when we say lean manufacturing, so it gives you a very limited view of Toyota production system.

So, to some extent, you can understand that lean manufacturing is a subset of Toyota production system and in this particular session, we are only going to focus on this aspect of lean because it is very important nowadays that organizations continuously need to shed all unwanted things and when I am saying that all unwanted things, so if you see any manufacturing organization, you go to their shop floor, you will see so many items which are not used since many years but still occupy the precious space in the shop floor.

You go to office, in your racks there are files which are not used for many years, nobody has glanced through those files but still you are keeping those files in your office rack and that occupies the precious space in your office. If something is of value maybe archives then you need to have a separate location for those archives but giving the important space, giving the active space to those things which are not in use that is basically the meaning of lean aspect.

So, in this particular session, we are going to discuss that what is the meaning of lean and how we can achieve in lean system rather we will not be limiting ourself to manufacturing but we will see that lean is possible in entire business processes. It is possible when you are doing marketing; it is possible when you are involved in the distribution of products in the case of supply chain.

It is possible in the field of development of new designs; it is possible in training and development, so whatever field, whatever functional area you name, you can see that lean

aspect, the concept of leanness is applicable in all variety of fields. So, with this we start this concept of lean manufacturing. Now, the first thing is what is lean?

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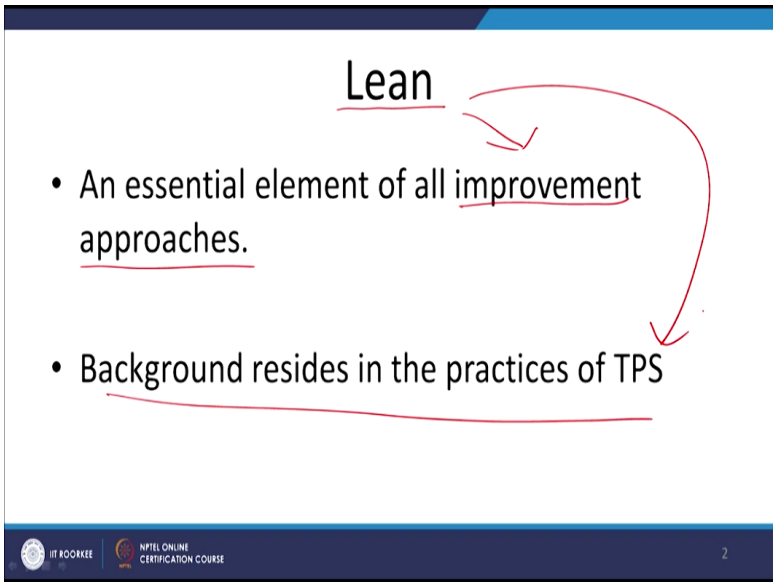

Now, what is lean? When we are discussing this, so we need to understand that the objective of lean is basically to improve our systems, it is not in itself an end, it is a way, it is a guiding principle through which the objective is to improve the organization, to improve our business processes and when we are looking for improving the business processes in current environment without going lean way, it is impossible to improve the business processes.

And as I already told you that the background of lean is already in the practices of Toyota production system. Since in last 4 weeks, we have already gone through each principle of Toyota manufacturing into the details, we have seen that how can we implement those principles of Toyota production. Therefore, it will be much easier for us in this session to implement the idea of lean in our business processes.

So, the idea of lean is basically for improvement and the background is available in Toyota production system. Now, just a quick recap, those could not attend our earlier sessions and if I want to discuss this in an absolutely independent manner.

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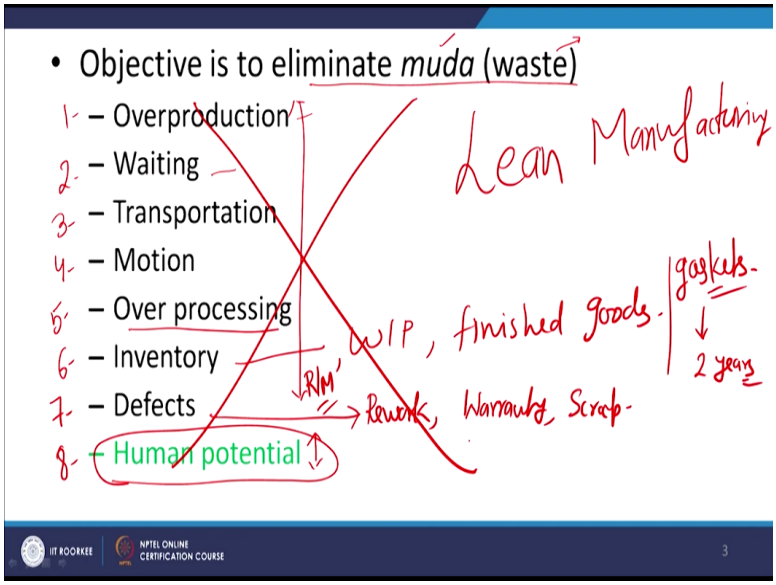

So, as per the Toyota production system, we have 8 types of waste, in Japanese muda is the term we call it that is the English meaning, that in English we call it as waste. Now, these are the original 7 types of waste and this green is the new waste which is basically coming from the philosophy of Toyota production only where the first type of waste is the waste of overproduction.

You are producing more than the requirement and here comes the concept of pull system which can help us in eliminating or reducing this waste of overproduction. If what is required by the customer, only that much is produced, you obviously eliminate the concept of overproduction but we all are in habit of producing in anticipation. We believe too much in the push philosophy and therefore we always create this waste of overproduction.

Then, waste of waiting that is also there. The first waste is of overproduction, the second waste is of waiting where some piece, some products, some people they are waiting for their turn to be processed, they are waiting for their turn to be sold into the market. So, at various stages, whether it is a supply chain, whether it is a production facility, whether it is a service facility, you see queues everywhere.

In queue, it can be a product, in queue it can be a human being but there are queues and queues everywhere and therefore lot of time is wasted in waiting only. So, that is a very important issue that how can we minimize that waiting time so that that time can be used for the productive purpose and therefore nowadays if you see that many people they use mobile phones, their social media when they are in queue.

So, that is in a way is a productive use of their waiting time. The third is the waste related to transportation. So, lot of movements are there and you take things from one end to another end many a times because of poor planning we do excessive transportation and how the optimization tools can be applied, how we can use some of the better mathematical modelling which can minimize our excessive transportation.

So, that is also a type of waste in the plant that is also a waste in the supply chain that is also a waste in the human efforts. The fourth is waste related to motion. Now, the waste related to transportation and waste related to motion many a times people get confused and waste related to motion is that waste where we create we are not moving from one place to another place.

When we are moving from moving from one place to another place that may result into the waste of transportation but when I am standing at a particular place, at that time also I may be doing lot of motions, motions of eyes, motions of hands, motions of my neck, these are the motions which are related with an individual. Similarly, machine may also be performing some idle movements.

So, all those are creating unnecessary, you can say output, it may be consuming some kind of energy, it may be consuming some resources and that is nothing the waste. So, that is another type of waste which we discussed. The waste of over processing; in quality management it is very interesting that we say that quality is fitness for use. Now, we need to understand that what is required to our customer.

And based on the requirement of the customer, you decide that how much to process because each customer may have different type of requirement and you have this pen in your hand, there is a particular requirement of hardness of this surface. Now, if you make this surface too much hard which may not be desirable but because of your poor understanding of the customer requirement, you are making this pen too much hard, therefore that is an example of over processing.

So, over processing is because of over specification, that much specification may not be required but you are creating something extra and that may result into the waste of over

processing. Then, the waste of inventory because you have over produced and when you have over produced, so you get either WIP work in process inventory or you get finished goods and sometime because of poor planning, you also get the inventory of raw material.

So, at all stages in your production process, you may have inventories. You may have inventory of unused spares. In our material management department, many a times it may happen that you say that gaskets are required and you see that gasket is available in my store but these gaskets are not used for last 2 years obviously because these gaskets are not used for 2 years, their rubber, the quality may deteriorate.

And as a result of that, these gaskets may become non-usable whenever there is a need. So, that is also creating a kind of waste. So, you have to be very careful in your material management, in your stores management, in your production planning so that you generate minimum inventory and that will again be a very important type of issue. Then, another is which is very common to understand that is the defects.

And if you are creating more and more defect, so you have more and more re-work, more and more you can say guarantee and warranty issues, more scrap will be generated, all these things will happen because of defects and when you are doing re-work, when you are having more issues of customer complaints, the customer satisfaction level will also go down and you are generating more scrap into your production process.

So, that all again will bring down your competitiveness, so all these things 1 to 7 are our traditional waste. Then, one more waste is added into this list that is coming with the green letters that is human potential. You have a lot of employees; they all are having some kind of creative ideas which your organization can actually use for its improvement but many of your employees.

Because we have already discussed that they are involved into the standard work, they are doing the routine work most of the time. So, you are unable to use their creative potential and when you are not able to use their creative potential so that is also a type of waste you are generating. You are paying them salaries but still you are not able to use their full potential for the organization success.

So, this is another type of waste which is happening nowadays in the organization because many organizations they believe on routine work and they give very limited scope to their employees for doing some kind of creative work. So, when the scope of creative work is very less, how you can use that type of potential and it is in fact I will say that criminal that you underestimate the potential of your employees.

So, each one of us has some kind of very interesting qualities, we all have some kind of divine into us and because of that we can be very useful in a particular situation. As a manager, as a CEO of the company I just need to identify that this person can contribute what and if I am able to use your potential to that particular scenario that is going to help the organization tremendously.

It will increase the morale of the people, it will create more respect to them, it will create better bonding between organization and the employees and at the same time you will have very high level of competitiveness. So, these are the actually different types of waste which our Toyota production system talks about and with the lean manufacturing, this lean concept will help us to eliminate all these waste.

We want to finish out all these waste that is the ultimate objective of lean manufacturing because if these waste are there, you cannot become a successful organization, you have lot of weight on your head and once that weight is not there, then you will have a different progress and that will give you higher level of success.

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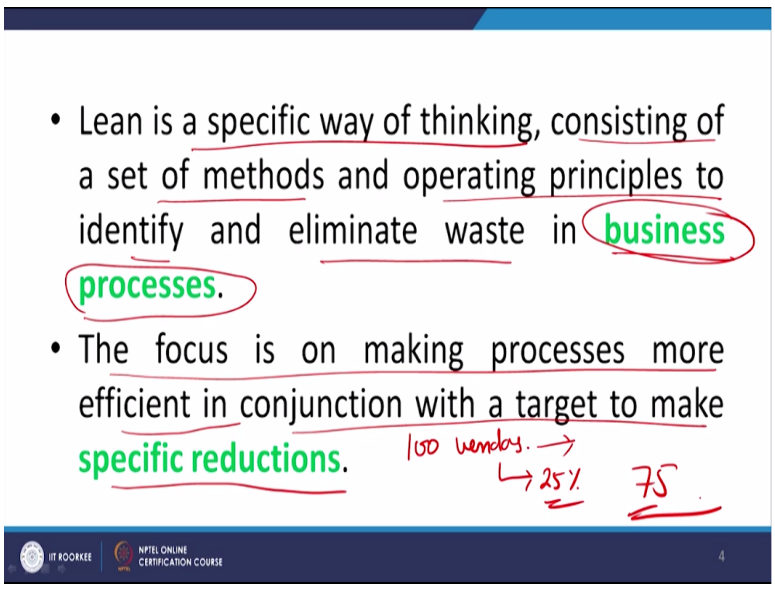

Now, therefore as we discussed in case of Toyota production system, here also we will say that it is a specific way of thinking, TPS also we said that is a philosophy based on 4P's. Same thing that lean is also a specific way of thinking. Now what is that specific way of thinking? That it is consisting of a set of methods and operating principles to identify and eliminate waste in business processes.

Now, this word business processes, this is especially highlighted. Why it is highlighted because it will create an approach that it is not limited to manufacturing. It can be applied to any business process, whether it is admission process in your institution, whether it is examination process in your institution, whether it is some kind of new product development, whether it is about the advertisement strategy for your company.

So, whatever type of situation you think of, you can apply the concept of minimizing the waste, identify what type of waste. We discussed in our previous slide these 8 types of waste, it is not necessary that everywhere all these 8 types of waste are there. It is subject to subject, it is process to process, it is organization to organization that somewhere only 1 type of waste is there, somewhere only 2 types of wastes are there and if all these type of waste are there, so you can think of that it is very difficult for that organization to survive.

But it is important that what type of waste is there in my organization I need to identify, I should have that kind of you can skills, capabilities which can help me to identify the type of waste in my organization. The second important point I like to highlight that the focus is on making processes more efficient in conjunction with a target to make specific reductions. When we are implementing lean in our organizations, we set very specific quantitative targets that we will reduce.

Let us say I have just a very simple example that I have let us say 100 vendors for supplying a particular product. As part of lean exercise, I may say that by the end of this year, I should be able to reduce 25% of my vendors. In 1 year, I want to reduce the number of vendors from 100 to 75. That is the specific reduction. So, like as part of lean exercise, I may implement Six Sigma and then I will calculate the specific reduction using my DPMO, defects per million opportunities.

So, these kinds of things are implemented when we are talking of lean manufacturing that under the lean system, we have specific targets to achieve. Now, as all these terms, Toyota production system, lean manufacturing, in our coming classes we will discuss about agile manufacturing, flexible manufacturing.

So, you will have various such terms, which are almost pointing towards the same thing but we see that what are the common techniques which will be applicable for making this philosophy successful.

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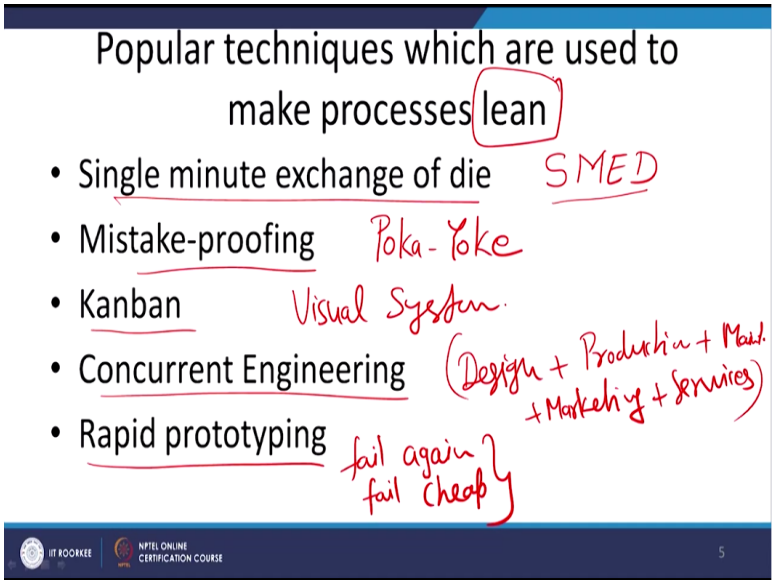

So, some of them are like SMED, single minute exchange of dies, so this is popular with the name of SMED that you are using same line for different types of products because volumes are reducing, variety is increasing and at the same time we want to reduce the changeover time that from one product to another product I want to produce the same product, both the products on the same line.

So, without wasting much time in changeover, I should be able to achieve highest level of output and that is possible through SMED. The principles of 5S will apply that you need to keep your next die ready and as soon as there is a time of changeover, you should replace this new die with the older die. So, that type of things we need to see. Mistake proofing that is poka-yoke that there should be correct thing in the very first attempt.

You cannot take a chance that this is a transient state, in the system of Japanese manufacturing, there is no scope of 1 or 2 initial failures right from the beginning we should

be able to produce correct output. The kanban, the visual aids, so that you can decide the movement of your inventory, what type of kanban you want to implement, whether it is electronic kanban or it is a paper-based kanban, that is up to you.

And we are going to discuss in our coming sessions, the entire calculations and the development of kanban system but kanban is used to minimize the waste of inventory so that we can follow the concept of pull system, we can follow the concept of one piece flow system effectively, for that kanban is used.

The concurrent engineering very interesting, the concurrent engineering is applied that the people from different departments, people from design, the production, the maintenance, the marketing, etc the services they come together and you get a cross functional team which is responsible for developing a new product. Earlier, the concept was like that whenever a new product development activity has to be undertaken, it was done by the product development department.

And then that drawing, that design goes to manufacturing people and they used to comment on that whether it is manufacturable or not manufacturable and lot of iterations used to take back forth kind of thing used to happen and therefore a new product development used to take years but nowadays we all know that product life cycles are reducing and therefore you cannot afford to take too much of time just for sending the design and getting the feedback.

So, nowadays the concept is coming that is concurrent engineering where you invite people from different functional areas and they make a single team and that single team can understand the strength and weaknesses of their department and accordingly we can reduce the time period of new product development from years to few weeks and therefore you will be able to bring new products regularly into the market without you can say taking that much of time.

Then, rapid prototyping because regularly we want new products and rapid prototyping will help us in developing the prototypes and there is a concept fail again and fail cheap so that if your prototype is not working properly, you should not incur higher cost of failures. So, that development of prototypes which was done with the help of dies etc and taking long time in the earlier periods that has now completely changed to rapid prototyping.

Because of that you are able to develop a single piece without much effort so your prototyping is done at a faster rate. So, all these are the popular techniques which are used for getting the leanness in your organization.

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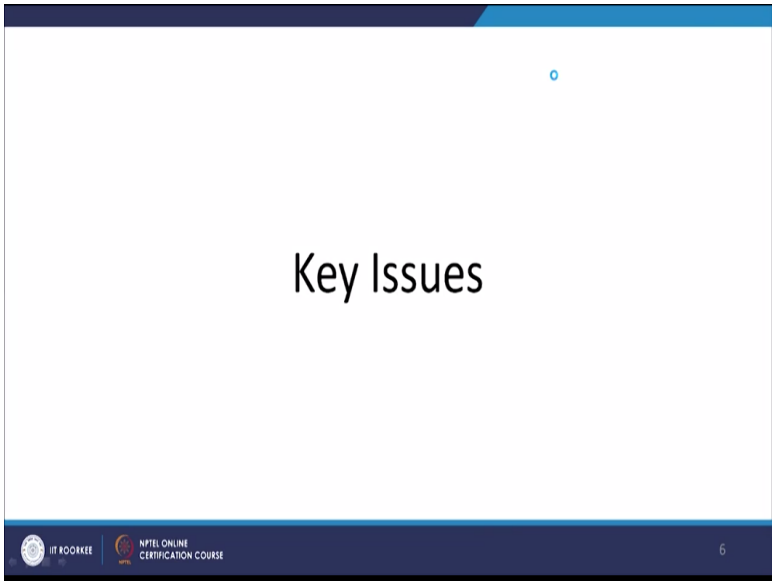

Now what are the key issues, let us focus quickly on some of the key issues which are important to understand the philosophy of lean. There are few items which we will be discussing.

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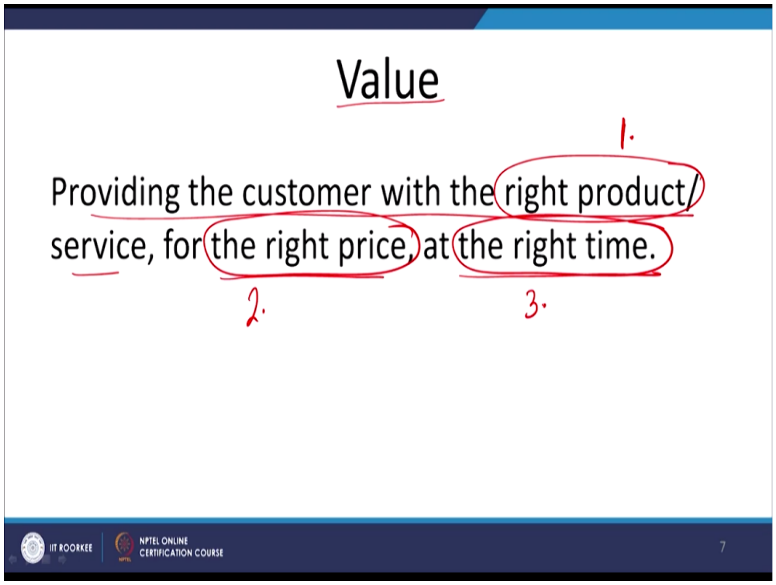

The first important term is value. Now, what do we mean by value because there is a managerial side of value and there is a spiritual side of value also. So, here we are discussing value in terms of providing the customer with the right product, service, for the right price, at

the right time. So, that is value to the customer and normally there are 2 perspective of value; one is the perspective of marketer or the producer, the other is the perspective of customer.

But nowadays because we all are living in marketing era, we only need to respect the customers view, so from the customer's point of view, the value is right product. You can say that there are 3 components of value; one is what product is required you are delivering that product, what is the purchase power of the customer, so you are giving the product in the same purchasing power and at what time customer is looking location and the time of delivery.

So, these 3 things decide whether customer is having value from your product or not having value from your product. So, that is one important aspect.

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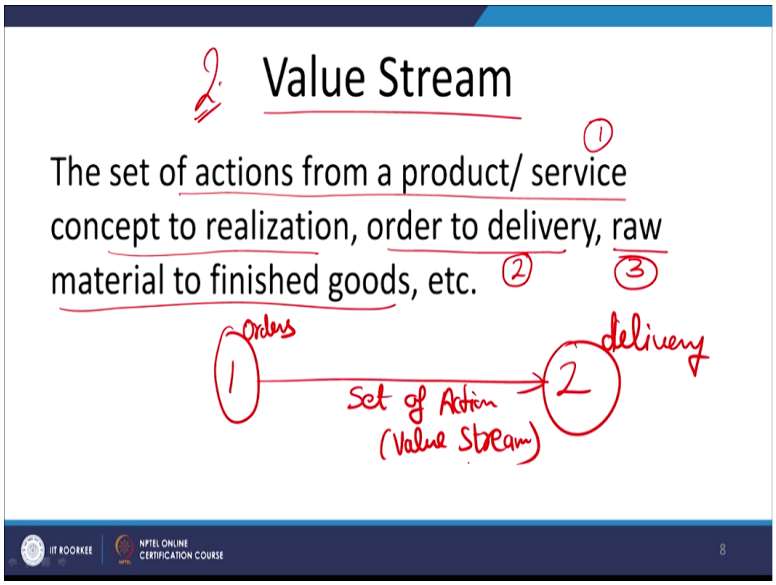

The second is value stream. In the value stream, you see the set of actions from a product service concept to realization. This is one way of value stream. The second way of value stream is getting order and finally delivering that product to the customer. So, that is also full of various actions, set of actions through which you are receiving the order and finally delivering to the customer.

From raw material to finished goods, that is another set of actions which convert your raw material into a finished product, so that is also a set of actions. So, these set of actions which are starting at a particular point 1, ending at a particular point 2 and these are set of actions

from which the orders are converted into delivery and these set of actions which are helping in conversion of orders into delivery, these are known as value stream.

And this concept of value stream is very important for our lean philosophy because what are the value adding activities and what are the non-value adding activities that will be very important to eliminate waste from your system. So, that is second important issue.

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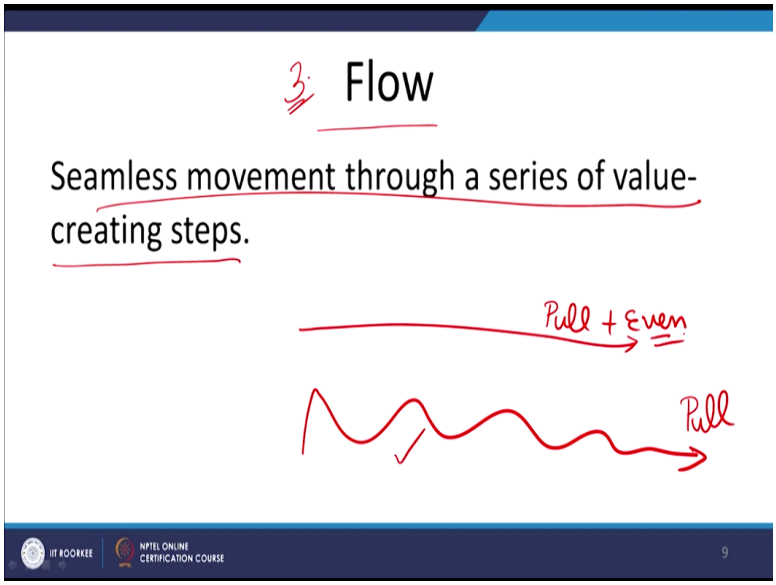

The third important issue, which we have discussed many a times in Toyota production system that is related to flow. Now, flow is we want to achieve the ultimate objective is one piece flow system but even if it is not a one piece flow system, you should have a smooth, seamless movement through a series of value creating steps. There may be flow like this and there may be a flow like this.

So, many a times when demand is more, you produce more. When there is demand is less, you produce less, so if you are not tuned into the Toyota production system, if you are not tuned into the lean philosophy and I am saying that we need to follow the pull approach, you say this is okay because if demand is more, produce more; demand is less, produce less but that unevenness will create lot of problem.

So, the beauty of this Toyota production system lean manufacturing is that at the same time it also says that you need to have pull plus even, you need to have pull system of manufacturing and you need to create evenness, smoothness in your system so that there are not these kinds of spikes in your production system or the flow of activities in your organization, that is

another important thing. Now, another important key issue is pull that you need to act only for satisfying customer demand.

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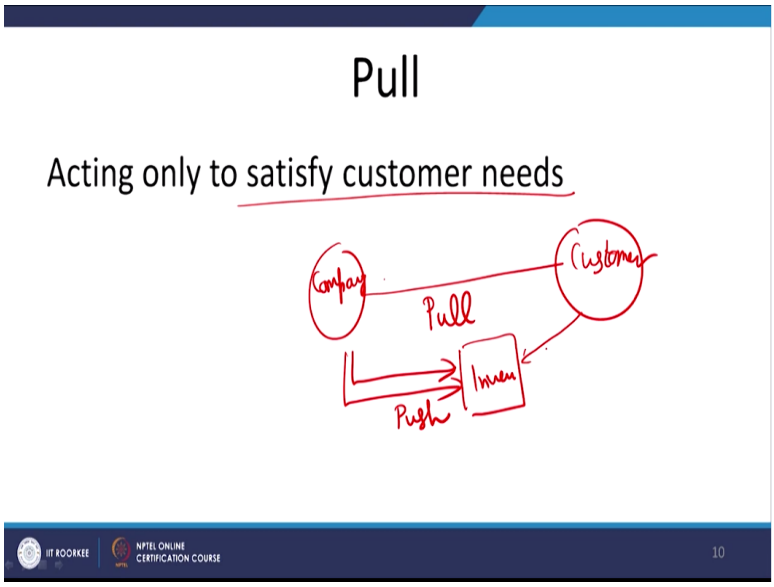

Whenever customer demand is there, then only you need to come out of there, then only you need to have some kind of action. So, this is customer, this is a company, so customer is pulling products, so pull is there. So, customer is taking the product from the company and therefore you will not be creating any extra inventory but when customer goes and find that things are already available in anticipation that is push.

And in this push, you create inventory and from here customer will purchase. Therefore, lot of waste is generated of inventory and that we need to sort out, we need to eliminate this waste. So, that is another key issue that wherever possible how to generate a pull-based system. Then, another important key issue is the perfection that we need to have a perfect system. Perfect system is first we need to have something then we need to standardize that something and then we need to have sustenance of that something.

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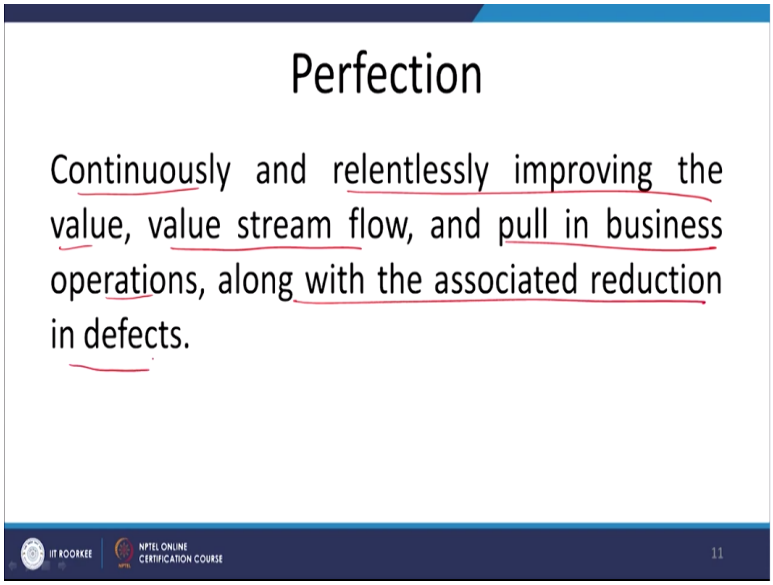

So, continuously and relentlessly improving the value, value stream flow, pull in business operations, along with the associated reduction in defects. So, what all we discussed under Toyota production system that is in summary is mentioned here that we need to develop a system which is working on its own, there is a mechanism of introspection and through that introspection we are continuously improving our system by identifying the value by identifying the set of activities which are contributing in that value development.

And by minimizing the defect and developing the learning of the organization that is what a lean organization means actually. So, with this we understood various aspects, the different dimensions of lean, what are the key issues in lean and we particularly like to highlight that lean is not related to manufacturing only rather it is a way of thinking which can be applied to any business processes. With this, we come to end of this session. Thank you very much.