Toyota Production System
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Lecture - 33
The Significance of Lead Time

Welcome friends. In our previous session we were discussing about implementation of lean philosophy. We discussed that it has some integrated role of operational then management and then at behavioral level. So it is a sequential way in which you are going to implement lean in your organization and for that purpose we discuss that how inputs are to be converted into some kind of value.

We have discussed the traditional model of operations where inputs are there, we do some kind of value addition and by value addition we produce some products, but now here in that incremental value addition we are actually producing value in the form of excellence in quality, in the form of lower cost, in the form of faster delivery. So all those are the different meanings of value which we discuss in the case of lean manufacturing.

We were discussing about different types of implementation strategies for lean. So that is one particular aspect we will be focusing in this particular session that what are those implementation strategies for lean systems. The other important thing which we are going to discuss in this session that is about the concept of lead time because Toyota Production System is having a very important aspect of reducing the lead time.

Because you are producing things in response of customer requirement, we are following the concept of pull-based manufacturing. So anybody can think that when you are having a pull-based system you will take lot of time to deliver products to the customers, things which are available of the shelf will have minimum lead time. A customer walks into a retail outlet gives the order, things are readily available in the shelf the shopkeeper will give you those products and you will come to your place of work.

So that is minimum lead time you order and you get it, but if those things are not available think of a restaurant no food is readily available. So you go to a restaurant and it is normally written on the menu card that 20 to 30 minutes will be taken for the service that is lead time.

You place an order and then cooking takes place, the waiting, the preparation all those things put together take some 20, 30 minutes' time to deliver those products to you, to supply your order to you that is lead time.

On our mobile you place order either through some food app or through calling to a particular restaurant it takes another some 30, 40 minutes to deliver that order to your door that is the lead time, how much time a company is taking in delivering the product once the order is placed. So the focus is in a pull-based system we follow the concept of reactive manufacturing.

That once the order is there then only the production is gearing up for delivering the product. So we need to solve these two you can say opposite questions. On one side we want to have pull manufacturing and on the other side we want to reduce the lead time also. So zero lead time when you have everything available of the shelf, but that is mass manufacturing that is going to increase your inventory waste so that is also not possible.

So therefore this concept of lead time is a very important thing unless and until we understand that what is the lead time and how can you minimize the lead time, the discussions of Toyota Production System are incomplete. So this particular session we will focus on two aspects. The first part we will deal with the implementation strategies for lean and the second part we will deal about the significance of lead time.

The implementation strategy for the lean as we discussed in our previous session that there are three interrelated items. One is at the operational level the second is at the management system level and third is at the mindset and behavioral level.

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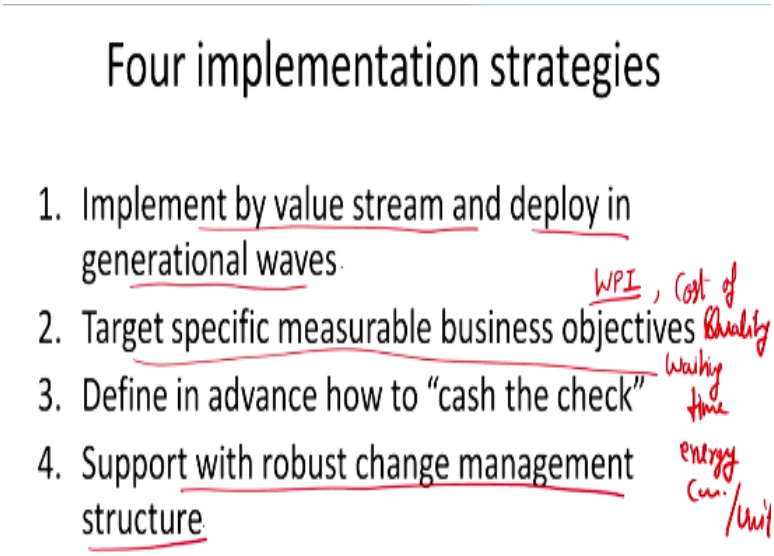

So what are those 4 implementation strategies we discussed that one implementation strategy is with respect to value stream and we need to deploy a system of value in our generation to generation that how in our successive generations we are able to implement this value system. Then the second is we need to target a specific measurable business objectives. We discuss that some specific measurable objectives can the level of WPI.

How much inventory you have at any point of time in your system so that is one measurable objective. What is your cost of quality, what is your waiting time, what is your energy consumption per unit of product? So these are some specific measurable aspect. So if for making one product I am using let us say 900 watt of energy so can I bring it to 700 watt. If I am able to reduce the energy consumption for making one unit of my product.

In fact, that is not reducing the energy consumption I am eliminating the waste, the extra energy which I was consuming that was a waste and that I am eliminating. So that is specific measurable targets which are able to improve by eliminating waste. Then define in advance how to cash the check. What you can say revenue generation you can do with respect to your various activities of the lean implementation that also you need to define in advance.

And when you have this definition in advance it is going to improve the morale of your team members and we also discuss this particular thing that implementing lean is more related to a new kind of philosophy where you need to change your mindsets. So it is requiring because whenever there are some kind of change, whenever we are coming out of our comfort zone we have a resistance a natural resistance for change.

So therefore you need to have a robust change management program. When you have a robust change management program then only you can succeed in implementing lean. So now let us discuss these 4 strategies slightly in more detail.

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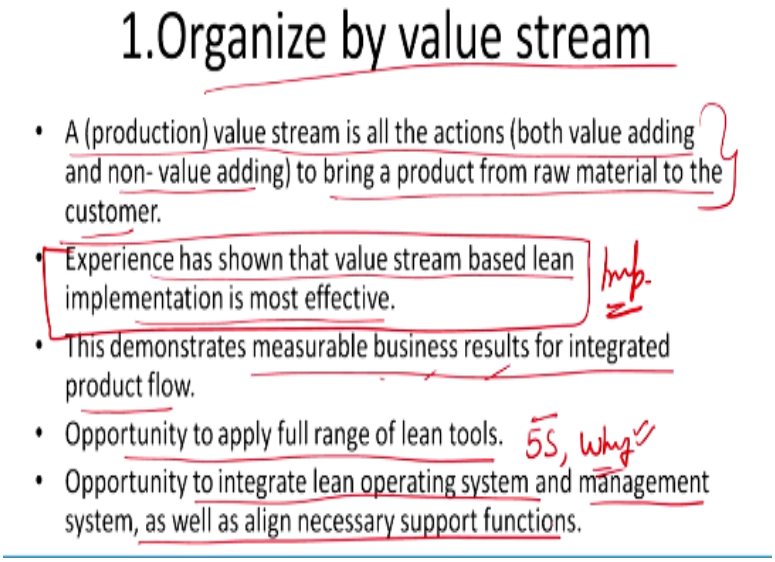

The first is organized by value stream so that you can have some kind of deployment in your generational ways one generation to another generation. What does it say? It says that a production value stream is all the action both value adding and non value adding to bring a produce from raw material to the customer. So from raw material from the extraction of (()) (09:05) to the finally going into the hands of the customer.

And even after that disposing of the product also is the different actions and in those actions some of the actions are value adding actions and some of the actions are no value adding actions. So the sum total of all those is actually known as value stream. Now experience has shown that value stream based lean implementation is most effective. So when you have a good idea of the value stream of your production process.

Then you will have a better lean implementation then you can easily identify what is non value adding and it becomes easier for you to eliminate those non value adding things. This demonstrates that measurable business results for integrated product flow. So because you are clearly having this demarcation between value adding, non value adding. Therefore, you will be able to demonstrate some kind of measurable business results.

It gives you opportunity to apply full range of lean tools, all types of lean tools for example 5S, why all these are the different type of lean tools we have already discussed you can apply at different stages. For example, if you have defects so in case of repetitive defects you will apply why as your lean tool so that you can go to the root of the problem. If you are having lot of clumsiness on your workplace apply the principle of 5S.

So that you can improve your workplace. So you can reduce the time of waiting because you can easily identify the products. So your time in waiting will reduce, you time in minor motions will also reduce. So different type of lean tools can be applied when you are having a good value stream. It gives you opportunity to integrate lean operating system and management system as well as align necessary support function.

With the help of value stream, you can create a more integrated system in your organization. So whether it is operation level, whether it is management level or whether it is at the philosophical level where you are talking of mindset that is also possible to integrate with this value stream concept.

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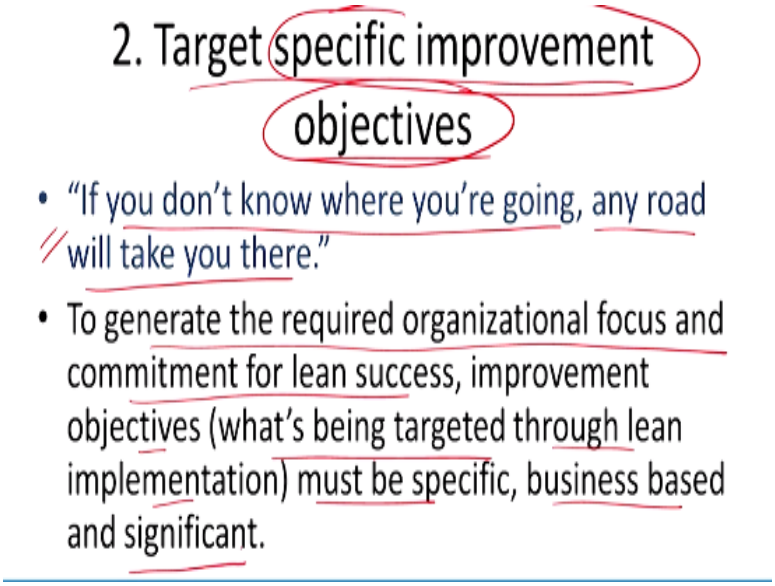

The second is target specific improvement objective that is the second implementation strategy and now in this particular case if you do not know where you are going any road will take you there this is a proverb and we know that if you are not going there so where are you going, your objective, your target is not fixed. So whichever road you are taking it will take you to somewhere, but you want to go there or not who will decide.

So whatever you will achieve you are going to be satisfied with that. So that is not the case with respect to lean system. It is just opposite to that you need to have some specific objective. When you do not have specific objective this type of situation will happen because you do not know which route to take, where you want to go. So to generate the required organizational focus and commitment for lean success improvement objectives.

What is being targeted through lean implementation must be specific business based and significant. So therefore what is required, what do you expect from lean implementation that is important to identify and it should not be a smaller thing, it should be able to excite the whole organization and when it is able to excite the whole organization then only you will have a larger cohesiveness in your organization.

If I am talking for a university so if I am applying the lean tool and I say that this will depend Department of Physics. So probably the Department of Mathematics, Department of Chemistry, Department of History, Department of Earth science they will not be excited because the specific improvement objective is limited to a particular department. When the improvement activity will lead to benefit the entire organization that is going to help bring people together.

So therefore it must have a significant role in deciding the improvement objective. So that is also a very important strategy that what type of objectives you are selecting in lean system.

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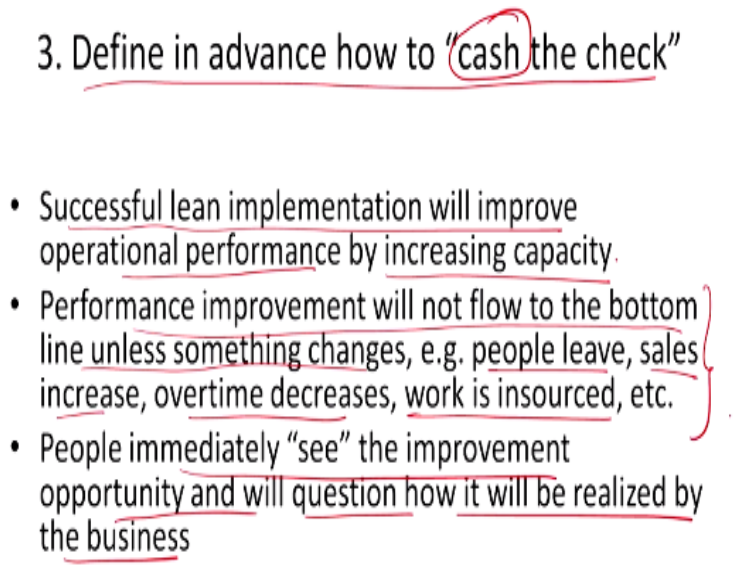

The third is define in advance how to cash the check, what type of revenue you are expecting

from these activities that also you need to decide in advance. So what does it say? It says that successful lean implementation will improve operational performance by increasing the capacity because you are reducing the waste you will have more product availability; you will have better asset utilization.

So it will actually help you increase the capacity and when you have more capacity obviously your revenue can increase. Performance improvement will not flow to the bottom line unless something changes for example people leave, sales increase, overtime decrease, work is in-sourced all these things are different form of cash. Cash does not mean hard money hard cash if you are now more liberal in giving leaves to your employee because of better asset utilization

If you are able to give more bonus during festival time that is also one form of cashing. So there are you are requiring less overtime now, workers are able to work only during their straight times. All these are the different forms of cash the check. So people immediately see the improvement opportunity and will question how it will be realized by the business. So when the opportunities are there most of the people are able to sense those opportunities.

But when it is clear to them that how these opportunities are going to be used by the business if whatever benefit is coming from those opportunities are limited to the top management. So the people who are able to see those opportunities at the lower level in your organization will not like to become part of those opportunity creation. So they see that all these things are only benefitted by the top management so why should I contribute in giving those opportunity.

So therefore we need to create a system where we can pass when we can you can say distribute this cash this benefit to all people in my organization and therefore you see if this system you are able to have this is going to help organization so much that everybody will see that how can I identify new opportunities to eliminate waste and through that something will be happening and the fruits will be shared with us also. So that is another important part of implementation strategy for the lean organization.

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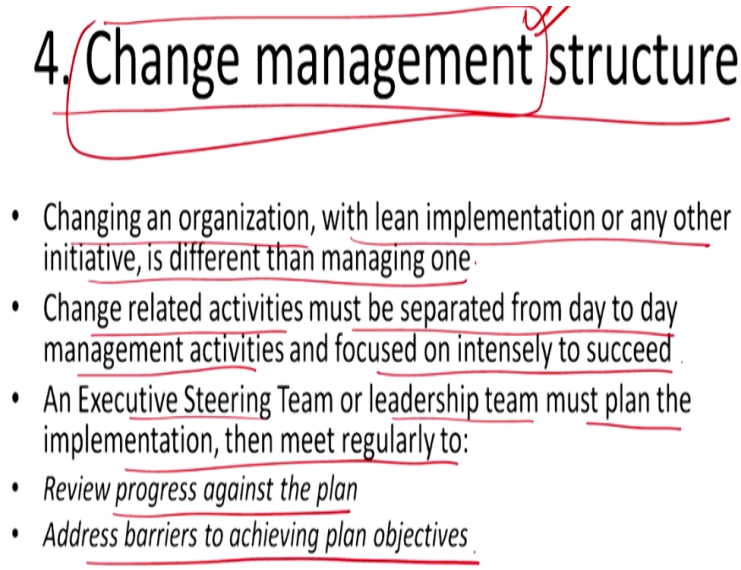

The next strategy the fourth one is changed management structure. We need to have a robust change management structure, lot of changes will happen when you are changing yourself from a mass manufacturing organization to Toyota Production System of organization so therefore you need to have a robust change management program in your organization and under this robust change management program what is expected that changing an organization with lead implementation or any other initiative is different than managing one.

Because when you are managing something on routine you will not have these kind of challenges, but when you are trying to change the direction or the philosophy of the organization it creates new type of challenges. So that is one important point where this change management is required. Change related activities must be separated from day-to-day management activities and focused on intensely to succeed.

Change management activities are different than our day-to-day management activities and you need to focus on those challenge management activities very intensely for success. An executive steering team or leadership team must plan the implementation then meet regularly you need to create a separate team for change management and this team must meet very often for the purpose review progress against the plan.

So that you know how much are we achieving and address challenges to achieving plan objectives. So it regularly monitors the performance and it regularly identifies it regularly tries to see what are the challenges coming in our way for achieving these change results so how can we eliminate, how can we overcome those barriers which are stopping our progress

as per the desired objectives.

So that is the objective of this change management structure strategy. So these are the 4 important strategies for implementing the lean in my organization. Now once we have covered this particular part the next part of this session we will focus on lead time.

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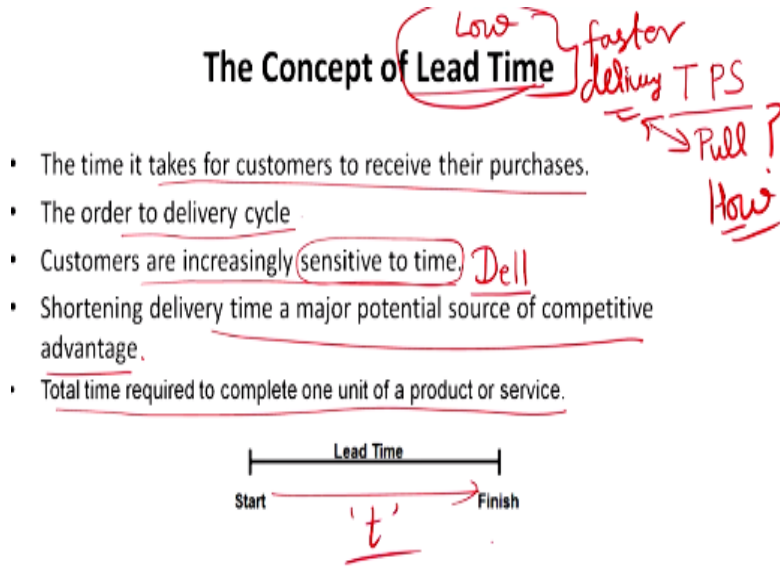

As we discussed that the lead time is a very important phenomena and you will always have questions that when we are talking of Toyota Production System where we are talking of pull way of manufacturing. So in pull way of manufacturing without second thought it looks that your lead time should be higher because things will be manufactured, things will be produced only when order is there.

So how you are able to fulfill the value of faster deliveries if we want to follow Toyota Production System and all the other side we want to achieve the value of faster delivery. If you recall our last few sessions where we were talking of lean implementation. So in lean implementation we want to generate some kind of value, the output is seen in the form of value. One of the value is faster deliveries.

So faster delivery means low lead time this is faster delivery, but on the other side we have pull manufacturing. So the question is how you are going to achieve faster deliveries in pull environment. So for that purpose this part of this session will help us. The time it takes from customer to receive their purchases that is the lead time the order to delivery cycles. Customers are increasingly sensitive to time it is very important.

And we will not take time, but you know the story of Dell Company that Dell was distributing their products through online system and customers were purchasing Dell products because you were given the opportunity to design your computer as per your choice, but over a period of time Dell recognize that customers are now not interested in waiting for their machines which was taking around 2 to 3 weeks' time to deliver.

Because customers were more interested to have some kind of generic system, but they want immediately. So Dell also started retail outlets in various parts of the word and now even in Tier 2, Tier 3 cities in India Dell computers are available through retail outlets about 12, 13 years back Dell computers were not available through retail outlets. Till 2005 Dell computers were only able to get from online orders.

But in country like India it used to take more than a month to get Dell computers, but Dell realized that customers are becoming more and more sensitive to time and therefore they changed their distribution model and they came into the retail distribution on their products. So therefore this example is good enough to suggest that how customers are becoming very much sensitive to time.

Shortening delivery time is a major potential source of competitive advantage. For large number of companies not only for consumer goods, but for industrial goods also for the project organizations also those companies which are able to deliver products in promised time and in that time which is even shorter than the customers expected time that is going to be a major competitive source for organizations.

So that is why the significance of lead time is very much then the total time required to complete one unit of a product or service that is the lead time and it is starting from here and finishing here. So this total time is known as lead time.

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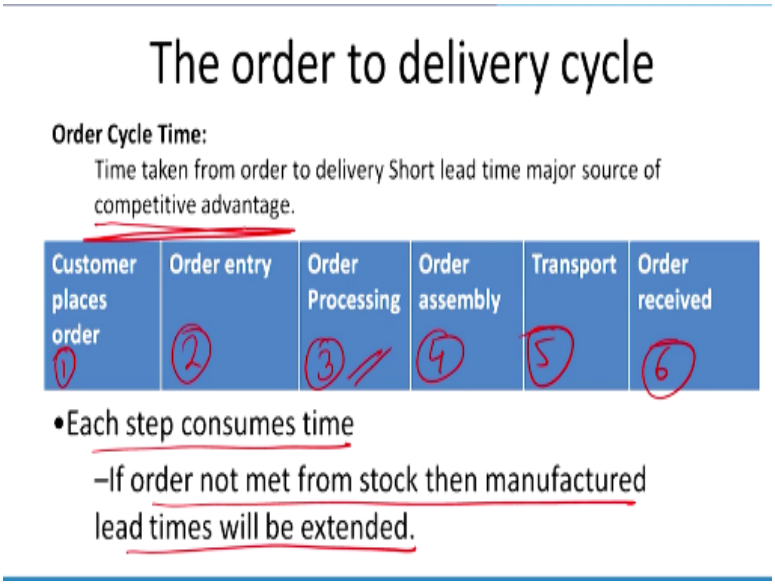

So just to explain further with the help of this diagram so customer places the order this is step number one and then your order is entered in the system order processing takes place assembly that is the part of processing and then it is distributed through some kind of transportation system, logistics and finally customer receives the order. So all these are the different types of processes which are happening from the placing of order to receiving of order.

The different activities, each step when customer is placing the order sometime you are placing the order online and it takes lot of time for placing the orders. There may be variety of reasons maybe your internet is not working properly maybe at that particular time the sight of vender is not properly functioning maybe at that particular time your payment gateway is not functioning properly may be at that particular time some other congestion is there.

The heavy load is there on the sight and therefore sight is not functioning properly. So there may be variety of reasons and the time you are taking for placing the order is important. So how much time is taken for placing the order then order is entered into the queue at the vender's end then processing will start the order will be assembled so that it can be deliver to the customers.

And then through some transportation system it will go to the customer site and then it is received by the customer. So you see that each step consumes time. All these steps from 1 to 6 these steps actually consume time and if order not met from stock then manufactured lead time will be extended. So all these things we are normally expecting that order is meeting out

of our stock.

But it is not met from the stock then order processing time will get further elongated. So it is important thing that how we get this competitive advantage. This if you are able to shorten your lead time it is going to provide you a very strong competitive advantage and that is a very important thing which we are discussing right now.

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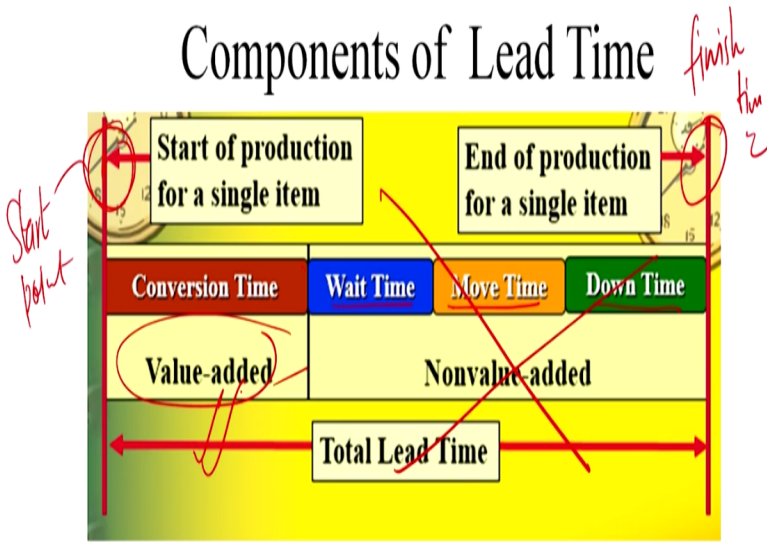

So in the diagrammatic form if you see this components of lead time. So here you see that start of production of a time so this is the starting point and this is the finish time. Now out of this entire total lead time you see that this part is the conversion time and then there are waiting time some WIP are moving from one place to another place then sometime it is also possible the machine is down.

Tool is not properly working so you have to repair the tool etcetera all these things happen at the shop floor and therefore out of total lead time you see the component of value added time is much smaller and the component of non value added time is much larger. So the point which we are trying to discuss that we need to see that how we can we eliminate this non value added time.

If we can eliminate this non value added time and if only this value added time is there so how quickly you can deliver products to your customer and that is the key for your competitiveness if we are able to eliminate all these non value added time it is going to help us in delivering the products at a much faster rate it is almost like delivering products from

your readily available stock.

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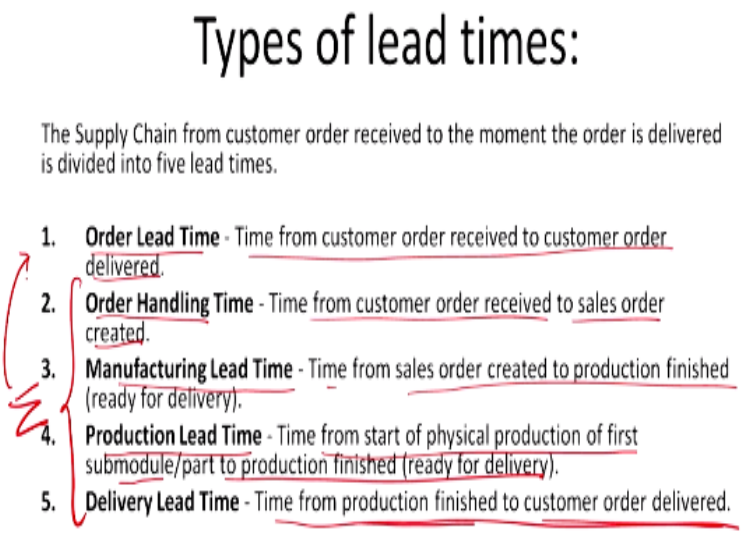

So the next issue is what are the different types of lead time and there are different types of lead time here we are discussing 5 different types of lead time and 5 different types of lead time are the order lead time, the time from customer order received to customer order delivered. So this is from the time you give order to your supplier and you receive the supply. So the time elapsed between that is order lead time.

The second is order handling time, time from customer order received to sales order created. Now customer gives the order and then within internal system there is a sales order creation process. So the largest amount of time is taken in the order lead time others are actually in fact within this order lead time these are the different components of order lead time. So one component is order handling time how much time your internal system like if you back to this diagram that order entry time.

So that you are creating a order within the system that this order has to be processed that is this order handling time then manufacturing lead time. So now your sales has created the order that this product has to be delivered. Now you will start production and it will take some time to produce the product so that is the manufacturing lead time, the time from where the sales department has created the order.

And by the time you finished manufacturing of that product that is manufacturing lead time. Then next is production lead time. Time from start of physical production of first sub module

to the production finished read for delivery so that is further sub component of manufacturing lead time that you have started producing the first unit from where and the completion of all the manufacturing units that is the production lead time.

And finally the delivery lead time once you have finished your production activity. So the production finishes and the customer order delivered that is the time of delivery lead time. So the sigma of all these is actually= order lead time. So under order lead time the customer is giving the order, receiving the order. So we actually include all these components within that order lead time.

So in our day-to-day practice unless and until we specify a particular type of lead time. Whenever we simply say lead time the meaning is this order lead time that time of delivering the order and time of receiving the supply the gap between that is known as lead time. So that is the generic meaning of lead time. So there are various kind of examples through which we just explained that what is the meaning of lead time.

And how it is affecting our competitive advantage. So these examples are available and you can see in large amount of settings and that we will prefer those suppliers who are having 2 important things. One is that they have a short lead time and they are able to deliver on their committed dates. So both these qualities are required with respect to delivery, with respect to lead time. They should have shorter delivery period and they should be able to deliver on time.

Whatever dates they are committing they are able to deliver. If you see in India in our project management one of the important dimension of project is time, but many a times almost all times you see that we exceed the time limits. Therefore, our projects are not competitive projects. If a project has to be completed in 5 years, but if it takes 10 years how you can you achieve profitability, how can you achieve cash out of that project.

So therefore in India it is a very important thing that how to minimize or how to actually follow whatever is the committed lead time you need not to worry about reducing the lead time, but at least the primary thing is to have on time delivery. If you are able to achieve OTD you have achieved 80% to 90% of success from my point of view, then the next level will come where we will think of how to reduce the lead time.

So these examples are helping us to understand that very concept of lead time. So if we simply try to understand the concept of lead time.

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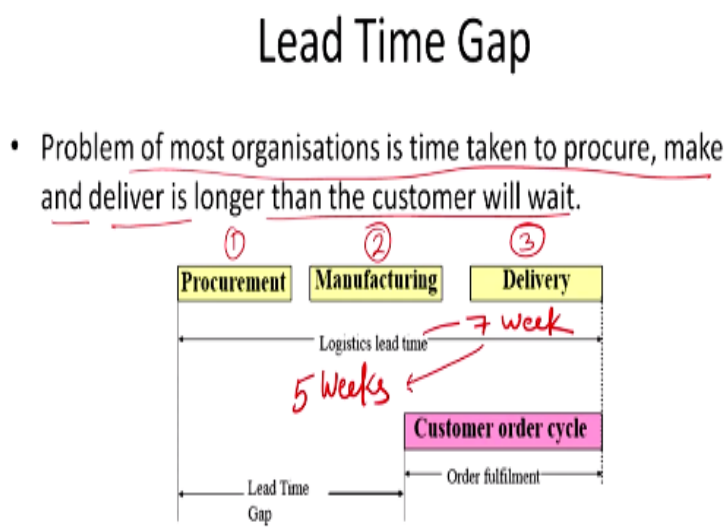

So there are 3 important things in which you have this lead time. One is the procurement, the second is manufacturing and third is delivery. So problem of most organization is time taken to procure, make and deliver is longer than the customer will wait. So customer is ready to wait for let us say for 5 weeks, but (()) (36:12) time is 7 weeks and this is a problem for many organizations in India that our these 3 activities take more time than the customer is actually ready to wait.

And therefore we are again and again say that if we are able to match the customer requirement we will be in a more competitive condition we will be having more competitive advantage that is the case and therefore this has to be some kind of system where we do not do everything in response. We may have some kind of readiness available with us and then we do final preparation so that kind of modularity we need to see to reduce the lead time.

In our next session, we will be focusing more about reducing the lead time, how to have lead time reduction strategies that will be the major focus in our next particular session.

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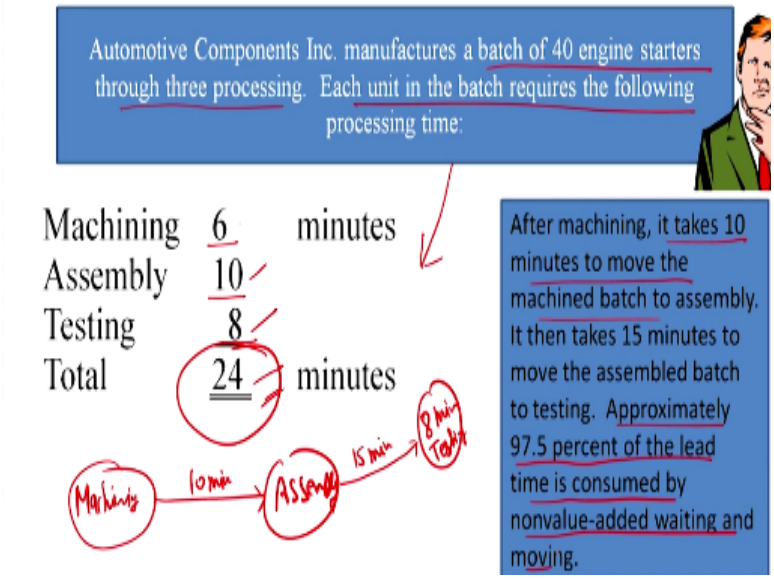

So here you have an example where in a company that you are making a batch of 40 engine starters using 3 processes and these 3 processes are machining, assembly and testing. So 6 minutes machining, 10 minutes of assembly, 8 minutes of testing total 24 minutes you are having the value added activities. So that is the each unit in the batch requires the following processing time.

Now what is actually happening in the company. So you are doing machining after machining it takes 10 minutes to move the machine batch to assembly. Now it is taking 10 minutes' time for the assembly shop where you have to do assembly. It then takes 15 minutes to move the assembled batch to testing. Then another movement which takes 15 minutes before it takes testing.

Testing takes 8 minutes approximately 97.5% of the lead time is consumed by non value added waiting and moving. So you see that out of entire process you have 24 minutes are being taken by the processing, 25 minutes are taken by the movement and then there are certain waiting time also. So out of entire processing time your 98% of the time is consumed by non value added things. So that is the actual problem area.

If we are able to address this non value added time we will be in a much more competitive situation.

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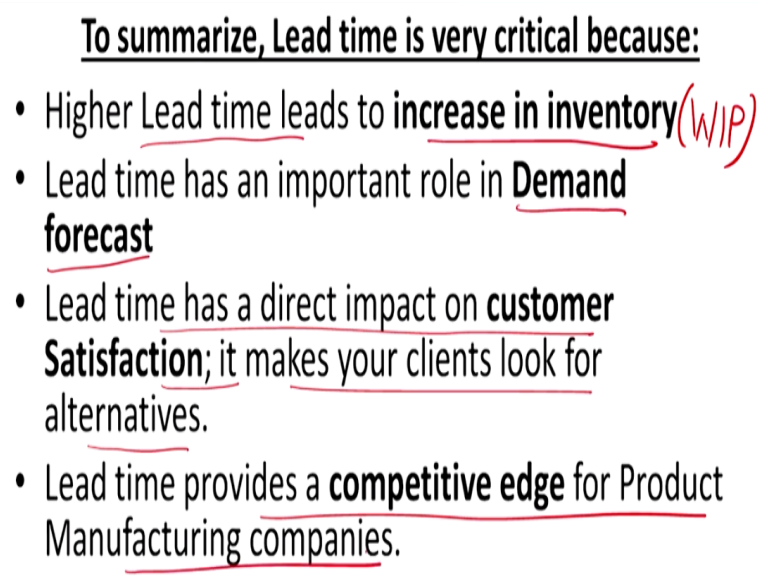

So that is if we summarize that lead time is very critical for any organization because higher lead time leads to increase in inventory everywhere particularly your WIP will increase tremendously because of higher lead time. Lead time has an important role in demand forecasting You need to have good forecasting so that you do not overstock, you do not under stock.

Lead time has a direct impact on customer satisfaction, it makes your client look for alternatives. If you are not able to fulfill the requirement of the customer on due dates so customers will think some alternative sources of procurement. So if you are able to deliver on time they are also in the part of supply chain. So therefore it makes your entire supply chain more reliable.

Therefore, we say that it is directly not having the immediate customer, but the overall customer satisfaction is very much depended on your ability to produce on time and lead time provides finally a competitive edge for product manufacturing companies so those companies where large number of activities are happening where customer is not involved. Particularly the manufacturing companies, in service companies the customer is involved almost at each stage.

So customer is also party to this lead time phenomena. So he or she is able to appreciate why delays are happening, but because in manufacturing company's customer's role only come at the last stage at the retailer stage. So he is totally blind about various processes happening in the supply chain. So therefore the role of lead time becomes very critical it can provide you

tremendous amount of competitive edge in a manufacturing environment.

So we discussed what is lead time and how it is very, very important for manufacturing organizations. Now some of the important strategies so that we can minimize our lead time that we are going to discuss in our next session. Thank you very much.