**Manufacturing Strategy**
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**Module - 7**
**Lecture - 32**
**Value Added Engineering**

Welcome friends. In our last session, we discussed about some of the important critical success factors for world class manufacturing. And when we were discussing those factors, one of the factor which we discussed is lean manufacturing. That elimination of waste and before that, identification of waste in a systematic manner is one of the important prerequisite for getting into world class manufacturing journey.

And in this particular session, we will like to discuss that, what is the meaning of this value added engineering. Because this value added engineering is nothing but the lean manufacturing, where we will identify various waste and we will see that how these waste can be eliminated. Because a lot of organizations; and when I say lot of organizations, I am trying to maintain my domain of discussion that these are our small and medium enterprises in India where they do not understand the concept of lean manufacturing, they do not understand the concept of value added engineering.

And therefore, they generate huge amount of waste. And as a result of that waste, they lose their competitiveness. And there is urgent requirement that we update these organizations. We create some kind of awareness with respect to non-creation of waste, so that, these organizations become lean organizations. They can follow the idea of value added engineering. And, then they can move on the path of world class manufacturing.

So, let us see that what is this concept of value added engineering. What are the different types of waste we can think of? And what are the steps we need to take for elimination of these waste? So now, let us go in more detail. So, this concept of value added engineering was proposed by Hall in 1987.

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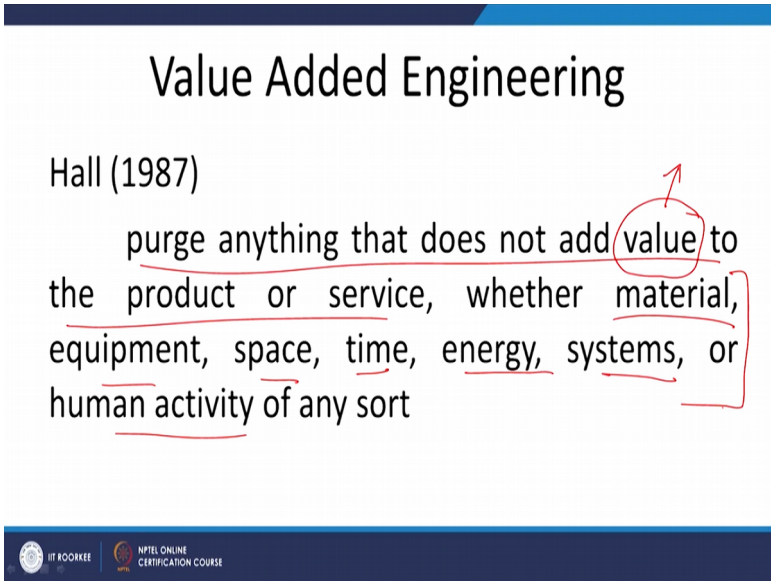


And according to Hall, we need to eliminate anything that does not add value to the product or service. So, this is the fundamental thing, that eliminate all those things which are not adding value to the product or service. Now, the important thing is that, many a times, we do not understand the meaning of this word value. This is such a subjective thing that something is value to me, but may not be value to you.

So, there is a requirement to further elaborate the concept of value in line of products and services. That we need to understand that all products are meant for some kind of service. Needs to provide some kind of a value to your end user. If products are not providing that value to end user, customer will not be satisfied. So, the measure of value, I think should always be from the point of view of the end user.

That whatever things I am doing in my processes are these things, are these actions helping in improving the customer satisfaction who is finally going to use that product or not. So, if I have that end customer's perspective in my mind, I can very well agree on the concept of value. But when I find that customer is not important, my process is more important, what I am doing is more important; and whenever I change my stand in this favor, then there is a conflict, then there will be a variation in understanding the concept of value.

So, there is important thing that we need to have 1 agreement on the concept of value that what is value. Now, this value is related to material, equipment, space, time, energy, system or human activity. So, these are the different types of things which can create non-value. And

therefore, when we will go into the detail of this particular issue, we will see that you may generate waste of material or you can generate waste of human activity.

So, there are different types of waste which are possible because of materials improper use, because of improper use of equipment, because of improper use of space, because of a poor scheduling of your equipments, because of a simple waste can be like in our houses, we know that sometime, we keep our air conditions on, even if nobody is sitting in that office or in room. So, that is a very simple example of how energy is wasted.

The systems waste, that we are putting our energy or; energy means our efforts; in that direction which is not in line with the organization's objective. So, that is the waste generated at the systems level or human activity. That our people, our manpower is involved in some activities which are not desirable, our priorities are wrongly set. So, all these things can contribute for the waste that is to be eliminated. That is to be identified in a systematic manner and then to be eliminated. That is the idea of value added engineering.

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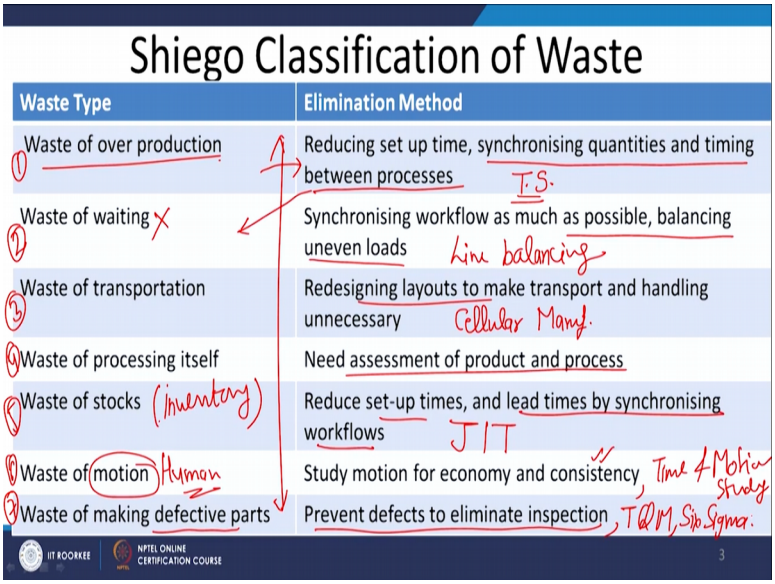


And for that purpose, Shiego classified different types of waste. And this is a very very important understanding that, what are the different types of waste according to Shiego. And, then we see that how can we eliminate the waste. Because it is very difficult for us to identify all types of waste in my organization. So, this Shiego's classification is a very simple way of determining the different types of waste.

So, these are, you can say, 7 different types of waste. And let us see what are these different types of waste. Here, the first type of waste is waste of overproduction. When you do not have proper forecasting; if your forecasting is improper, you result into waste of overproduction. And nowadays, we all know that organizations are not competing with another organization. Rather, a supply chain competes with other supply chain.

And in supply chains, you must have heard the concept of bullwhip effect. Now, this bullwhip effect is a result of waste of overproduction. Because we are not doing accurate forecastings and we all want to have a factor of safety. And because of that factor of safety, we are producing more and more. We do not want to get stocked out. And therefore, this waste is generated throughout the supply chain.

And this is 1 very simple type of example to understand. And every year, now in India or in our e-commerce business, we see that there are end of season markdowns. And end of season markdowns are so high, you get products at 50%, 60%, 70% discounts. And that is a simple example that how waste of overproduction is there in this situation. And this is obviously consuming all types of input resources.

And you are not getting any value out of them. So, this is 1 type of waste; waste of overproduction. And because our data analytics and all such kind of information is not appropriately available, therefore this waste of overproduction is a significant one. If we are able to use our business analytics, data analytics; we can do predictive modelling; to some extent, we can minimize the waste related to overproduction.

Then another waste is waste of waiting. Waste of waiting is because of queueing problems. So, you have a machines. And in front of machine, large number of jobs are waiting for their chance to process. So, that is waste of waiting. You have a, more waste of waiting is indicated by higher amount of inventory known as WIP. If you have a high level of work-in-process inventory, it means you are generating high level of waste related to waiting.

So, reduce your WIP and concepts like GIT etcetera are helping us to reduce the waste of waiting. But more WIP means more holding cost. And again, this will result into higher cost of production. And that is not desirable in a world class manufacturing environment. So, that

is the second type of waste. And many a times, we are not able to consider that waiting is a type of waste.

We consider that waiting is part of process. And therefore, we totally, you can say, neglect such type of waste. Then, third type of waste is waste of transportation. In our plant, if layouts are not properly available, then what will happen from process A to process B to process C? Your jobs are moving in all the corners of your factory. And when excessive movement is there, we all can understand it takes time, it takes energy.

And the excessive movement of goods, excessive movement of your WIP is not going to add any value to your product. So therefore, the layout designs; how are you designing the layout? One of the very popular type of layout which is developing nowadays is the cellular layouts. So, cellular layouts are a technique for helping us to reduce the waste of transportation. Earlier, we have the system of job shops in most of the cases.

And when job shop type of system is there, that is going to create lot of transportation related waste. And therefore now, cellular layouts are more popular, which help us in reducing the waste related to transportation. Similarly, I am giving you this scenario within a manufacturing organization. But you can also think of some organizations where you have a supply chain. But where you are making your different facilities and where is your market?

So, if your facilities are not close to market, you will incur higher amount of waste related to transportation. So, it is always advisable to develop your facilities closer to your market or closer to the raw material. So, either of these 2 points should be taken into account for developing the facilities. But if you develop your facility to a third location which is neither close to the market nor close to the material site or the raw material availability, that facility is going to create lot of waste related to transportation.

So, that is another important type of waste proposed by Shiego. Then, waste of processing itself. Now, we need to do only that much processing which is desirable, which is desirable for the end customers. Like we have a 4 year engineering program, we have a 2 years management program. Now, in 4 years engineering program, we are offering some subjects related to core engineering discipline.

You are a mechanical engineering student. So, there will be some credits. Some means, the maximum number of credits will be of the mechanical engineering. But, there will be few credits which are from humanities, which are from management, which are from other science streams. So, a comprehensive structure is prepared for your 4 years B.Tech mechanical engineering program.

But some other university thinks that, I need to give you some input about the medical sciences also; I should also give you some input for the legal aspects. And therefore, that university increases the number of credits. Now, those additional courses may not be adding any value to the end user, to the student who is passing the B.Tech mechanical engineering. But, this is a waste related to processing itself. That you are doing those processings which are not essential, which are not required for that product.

And that type of things may happen. And sometimes, it is happening. But we see that, these things go in this way. So therefore, there is no need to change. So, that waste of processing itself is a very critical type of waste, but it requires a comprehensive, you can say change in mindset. Then only you can realize that there are some processing related waster also. Then, another waste is waste of stocks.

Now, waste of stocks is a result of the first type of waste, that is waste of overproduction. So, waste of stock is in the form of inventory. When you are producing in large quantities and when there is a mismatch between demand and supply. When supply is more and demand is less, at that time, this waste of stock is generated. You pile up your inventories. And inventory is a very dangerous kind of waste, because it incurs the holding cost.

And you do not realize, you are not able to see that how the holding cost is taking away, it is eating all your profits. So, it is a very dangerous kind of waste. But, on the face of it, we are not able to see, we are not able to realize that this type of waste is happening in my processes. But it is a very very significant waste. And we will discuss that how you can monitor the waste related to your inventory.

Then waste of motion. Now, waste of motion is another type of important thing. We need to go to the studies of time and motion study provided by the era of scientific management. Gilbert, they contributed in developing the concepts of time and motion study. And in that,

they particularly mentioned that there has to be limited amount of movements. And I am very particularly trying to emphasize that waste of transportation and waste of motion are 2 different things.

So, waste related to transportation is physical movement of product from place A to place B; from place B to place C. But this waste of motion is not related to movement of product from A to B to C. Rather it is a kind of a, you can say vibratory motion at a particular location. So, like if I am delivering this session. So, if I continuously move here and there for delivering this session, that is the waste of motion.

So, most of the time, I am quite stationary. And that is the minimization of waste related to motion. So, there are large number of activities where people do different types of motion. And these motions are not adding any value to your end product. So, that is the meaning of waste of motion. So, many a times, people get confused with waste of transportation and waste of motion.

So, therefore it requires a very clear understanding that what is transportation and what is motion. And then, another important thing is waste of making defective parts. So, when you are making defective parts, so you require somebody to inspect your output. And there is the quality control inspectors who are sitting at the end of your production line. And their job is to inspect the final output of your system.

So, they are not doing any value addition. They are assuming, they have a prejudice that some defective pieces are made from this production process. And we need to identify, we need to identify those defective pieces, because those defective pieces should not go into the hands of the customer. So, because of this assumption, they are doing their job. So, what we need to do; we need to actually see that how process capabilities are improved, so that our system does not make any defective pieces, defective products.

So, these are the 7 types of important waste which were given by the Shiego. Now, let us see what are the elimination methods for these different types of waste. Because all these different types of waste require 1 thing in common. That we need to do lot of training, we need to do lot of tuning of our mindset, thinking. Because, for many of us, these are not the

type of waste. If you have a system of inspection in your organization; so, we consider that inspection is a functional activity.

But, if you see slightly into depth, if you have a broader understanding, you will realize that you require a quality control inspector only because you are not confident about your process capabilities. And since you are not confident about process capabilities, you think that your processes can generate waste. Therefore, you are hiring the quality control inspector. And the wages, salary of those quality control inspector is a waste, because that is not adding any value to your final output.

So therefore, it requires; but it is very easy to say, but very easy to comprehend. When we go to organization, we always consider that a quality control inspector is must for the organization. So, let us see that what are the different types of waste we just discussed and how we can eliminate those waste. Now, the first was waste of overproduction we discussed. Now, when we are talking of waste of overproduction, the first important thing we need to do; we need to adopt right kind of forecasting models.

That which type of forecasting model is more suitable. Many of the organizations; as I started this session, I said that small and medium enterprises, they do not have any kind of scientific forecasting systems. They go with more their intuitions. Their decision making is mostly on the intuitions. So therefore, they run into the problem of overproduction, because they do not have any proper data to support their decision making.

So, that is 1 important thing. And then, you also need to synchronize quantities and timing between processes, so that this overproduction does not take place. Because, if quantities and timing of processes are synchronized, you will also be able to handle the issue related to waste related to waiting. That how much you are able to produce from stage 1, which is going to fed stage 2. Then from stage 2, the output is going to be input for stage 3.

So, you need to have a proper line balancing. So, it is saying that, use the concepts of line balancing appropriately, use the concept of forecasting appropriately. And for that purpose, I will suggest that we need to implement the concepts of tracking signal first, which will give you an idea whether your forecasting is continuously over producing or it is continuously under producing.

If you have a fluctuation in your tracking signal, it means it is randomly fluctuating. And then, the waste of overproduction is minimized. So, tracking signal is 1 important thing. And the second important thing is synchronization quantities and timings at different processes. And this will also help us. This synchronization will also help us in eliminating the waste of waiting. Because, that will set the pace of your process.

That what is the time, what is the ideal time your processes are taking, so that you can adjust the output rate from your systems stage 1 to stage 2 to stage 3. So, that is also possible. And you need to have balancing the uneven loads. So, that is what I am saying that, line balancing is a popular tool which can be used for minimizing the waste of waiting. Unfortunately, again and again I have to say that, when we go to the real organization shop floor, we hardly use these concepts.

And therefore, we lack that kind of competitiveness coming from our manufacturing organizations. Then, another important waste we discussed, the waste of transportation. Now, for reducing the waste related to transportation, we need to redesign our layout. And unnecessary handling and transportation of goods should be avoided. And as mentioned earlier, the concepts like cellular manufacturing can be used.

Where we have layouts which can minimize your movement from 1 workstation to another workstation. So, the layout is divided on the basis of part families. So, 1 type of part family requires almost similar kind of manufacturing operations. And therefore, we are able to minimize these unnecessary movement and handling of intermediate products. So, that is the tool to eliminate the waste related to transportation.

Then, waste of processing itself. Now, for processing the, for reducing the waste of processing the itself, you need to do a thorough need assessment of products and processes. That for a particular product, how many processes are actually required? And if we can address this particular problem, that we do only those processes which are required for a particular product, then we can also solve issues related to rural markets; we can solve issues related to below poverty line product lines.

Because in that case, we need to offer only those features which are to be required by those markets, those customers. But what we do? We are trying to do so many things, but we do not

want to do complete processes. So, that way, the products are lost in their values. They do not offer enough value to the customer. And most of the products are unsuccessful in below poverty line, rural markets, slum markets, etcetera.

So, the good assessment of product and processes are required to eliminate the waste of processing itself; that how much processes are required for a particular end customer. Then waste of stocks. Waste related to inventory are another important type of waste. So, we need to reduce the setup time, lead time by synchronizing the workflows. Or you can say, we need to apply concepts like JIT, just in time; which will help us in eliminating the waste related to stocks and inventory.

So, JIT is not applicable within the organization, but we need to implement JIT with our suppliers, our vendors on 1 side and our distributors on the other side. So, it requires a much broader you can say horizon for the implementation of concepts like JIT. And this will help us in reducing waste of stocks tremendously. Then, waste of motion. Now, waste of motion can be eliminated by sound study of motion for economy and consistency.

And here, the concepts like time and motion study are very very useful. We need to make microfilms of our processes. And with the help of proper analysis of those microfilms, we can minimize, we can identify unnecessary movements during the production stage. And most of these waste of motion are related to humans. These are human related waste. And therefore, you lose your energy for working for 8 hours consistently.

So, if we are able to minimize the waste of motion, the consistency improves, the productivity of the worker coming for the first 2, 3 hours is very high. And once that worker is in the last few hours of his day's work, maybe seventh hour or eighth hour, that worker is prone to do more mistakes, because the consistency is not there. And consistency is not there because of lot of waste of motion is generated.

So, if we are able to reduce the waste of motion, we will be able to get more consistency from our employees. And then, waste of making defective parts. You see, when we are talking of waste, we normally consider waste in terms of defective pieces. But here, in this discussion of Shiego's classification of waste, waste of defective pieces is coming at the last, the seventh.

Because, Shiego believes that if we are able to solve, if we are able to eliminate first few waste, this waste of defective pieces will not come at all.

This is coming into picture because we are not able to do things related to point number 1 to point number 6. But if waste of defective pieces is there, then how to eliminate? Now, 1 way of eliminating the defective pieces is through inspection. But in present circumstances, because this Shiego's classification was given in 1981. But if I see in the present circumstances, we can eliminate defective pieces through implementation of TQM, through implementation of Six Sigma.

So, these type of philosophies help us in eliminating the waste of making defective pieces. So, these different types of waste are, you can say, major barrier for achieving the world class manufacturing. And we discussed various techniques for eliminating these waste. And now, I request those practicing managers attending this course, that they can make a challenge book, where they can make a separate page for each of these types of waste.

So, you can have 7 different pages in your diary for 7 different types of waste. And you can monitor the performance of your organization on a particularly frequency, maybe daily, maybe weekly, maybe monthly for different types of waste. And you see whether your efforts are reducing the waste or the waste is remaining constant or waste is increasing. So, unless until you have some quantified data, it will not be possible for you to go for improvement activity.

So, you need to get some data from your own organizations. And, on the basis of that data, you will be motivated to remove, to eliminate those waste. Because, first you need to identify the particular problem area. You need to have a focus on that. So, whether the waste of transportation is more important for your organization or waste of stock is more important for your organization; first identify 1 area, try to focus your energy on that and improve that.

Then you focus on other, then you focus on other. So, in that systematic manner, we will be able to eliminate most of the waste from our processes. And that is the concept of value added engineering. So, with this, we come to end of this session. Thank you very much.