Toyota Production System

Prof. Rajat Agrawal
Department of Management Studies
Indian Institute of Technology – Roorkee

Module No # 03
Lecture No # 12
Leveling Workload

Welcome friends, so, as we are already discussing the various principles of Toyota production system under the second P which is focusing on right processes to produce right product. We have discussed that how to create a single piece flow system or if you want to have a generalized version continuous process flow systems then how do we have the pull system in our manufacturing system so, that we can eliminate the waste of overproduction.

If we can eliminate the waste of overproduction, we can solve many of the problems which may come or which are there, but we may not be able to realize because you already having that kind of overproduction which heights, your all those problems, but it leads to inefficiency in the organization, it leads to lower profitability in the organization, it leads to poor competitiveness of your organization.

So, therefore, Toyota came with the concept of pull system and in the last of our previous session, we discussed that visual signals Kanban is a very useful tool to implement for the pull system in my manufacturing organization, not only in manufacturing organization, even in the service organizations also you can find the application of Kanban system you go to a bank, you go to a health center, you go to a gymnasium.

So, there are now visual signals available, which help you to plan your activities that went to move from one system to another system, when the system is empty, it will call you so there is no need of queuing in front of the system, waiting in front of the system that creates the waste of time. And therefore, this pull system is the second important principle under the process. Now coming to the third system, under this process value, and that third system is very interesting, because just know in the previous class, we discussed about the pull system.

And now I am saying the next system that is the system of leveling the workload. Now leveling the workload this system, this concept, this principle and the principle of pull system, if you see both these things, at the same time, you will get confused, why will you get confused because when I am saying leveling the workload means you should have almost the same level of workload all through the days.

On the other side, we say that we need to follow pull system whenever there is a demand then only you produce. So, either you can follow the pull system or you can follow the leveled workload that is whenever there is a demand produce, when there is not demand do not produce. So, that creates a kind of confusion, if we do not understand both these concepts simultaneously. Therefore, in this session, we will focus that how to achieve the pull system continuous flow system as well as be leveled workload.

And this is also going to help us in eliminating one of the waste that waste is of over stressing that waste is off overburdening your resources. So, because you are having a pull system, and if you do not understand the pull system properly, what is going to happen that on Monday, there is no demand. So, your employees are sitting idle and not doing much work at 4 O'clock and evening, you said to your employees that says there are no orders today, you can go to your home.

So, your resources, your machines, everything remains idle, and you did not get any return on that day all of a sudden on Tuesday, there are large number of orders and since there are large number of orders, now, at 4 O'clock, your employees started seeing the watches, but you said no you cannot go because we have so many orders and we are following pull system in my organization.

So you have to work you have to fulfill all these demands of the customer, because we cannot keep customer waiting also. So, you have to work overtime. So, workers are working for two hours, three hours, four hours, maybe up to 10 in the night they are working. Now you can understand that on day 1, they left the organization at 4 O'clock. Now on day 2, they are working 5 hours, 6 hours overtime.

And they will all get stressed they will all get exhausted and because they all get stressed exhausted, chances of errors will increase chances of quality defects will increase. So, that type of problem is happened when you do not understand pull system properly. And what will happen that after few weeks, after a few months, you will say that no this lean system this Toyota production system is not going to work in my organization.

I am happy with that old system of batch manufacturing, I am happy with that old system of mass manufacturing because one day there is no work other day there is so much of work because unfortunately or fortunately, whatever you say that you cannot predict the demand coming from the customer, you must have seen various examples that you go to a barber some time there is no customer in the barber shop and sometimes all of a sudden 4, 5, 6 customers come and there is a queue.

On a petrol pump some time there is no customer and sometimes all of a sudden 5 vehicles come. So, the customer demand pattern is highly uncertain, it is very difficult to identify when the demand will come though in our entire demand forecasting exercises, we try to model the customer demand, but still large number of uncertainties are there and because of that uncertainty is if you do not understand the right way of implementing the pull system, you will always have problems in implementing it and soon you will get exhausted soon your patients will give the answer.

And at that time, you will either invite some consultant or you will say that this lean manufacturing Toyota production system is not going to work for me and therefore, this particular concept following the pull system and then leveling the work, so that there is no extra burden, there is no overburden on your resources on a particular day, how to create evenness in your system. If it is even system then it is a smooth system, if it is uneven system, there are spikes in your system, you can understand that is smoothness has gone if these are the spikes.

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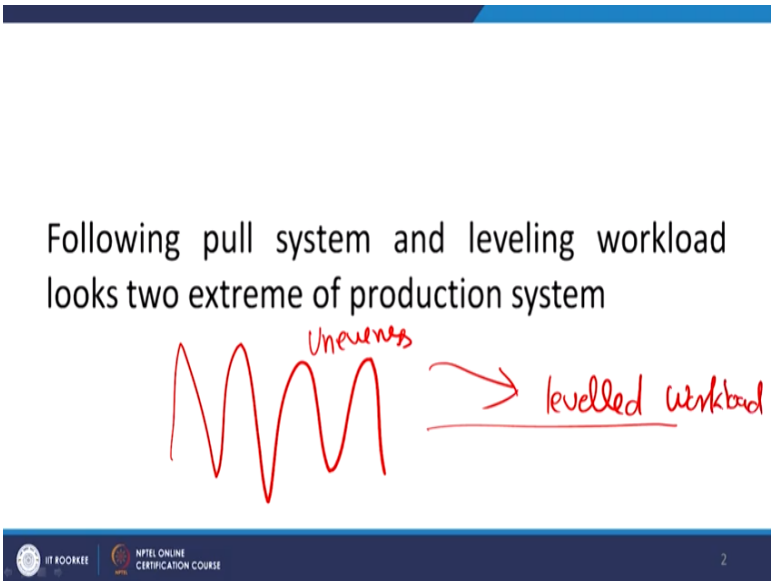

So, if spikes are there, this system is not going to work because all these spikes are going to remove the smoothness we want this type of system where the system is continuously working on a designed load that is the idea of this particular concept. That leveling the workload, this will create more predictability, you can decide on which particular date you are going to give products to your customers, it will create a sense of comfort to your employees, you can plan your various maintenance activities etc.

So, everything becomes a very comfortable thing for your organization, if you can remove this unevenness to this leveled workload. So, we want to remove this unevenness to this level workload by following the system of Toyota production system. And therefore, it is important to see this particular diagram where we are talking of 3 important M's of Toyota Production System.

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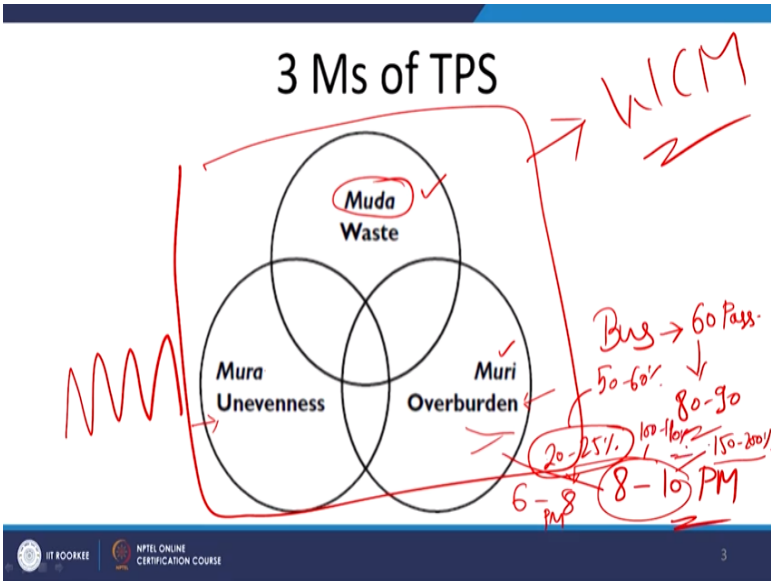

Now what are these 3 important M's because this Muda we have discussed many a times that we want to eliminate waste. So, that is a very highlighted word in terms of Toyota production system. So, whenever TPS comes to your mind, immediately, you think that I am talking of work, elimination of waste from the system. So, Muda is well known to us, but there are 2 more M which are equally important.

And as these three circles are there, so, there are a lot of interrelationships between these 3 M's, they are quite interrelated, they affect each other, and if you can help, if you can remove one, it will automatically help in eliminating other M's also. So, what are these 2 other M's one is Muri that because of your poor planning, because of uncertainties in the environment, you are following a pull system.

So, that may create overburden on your resources, sometime demand is high and because of that high demand, you are using your resources to a larger extent and that may create over stress on the resources. You have designed a system for an example in India we see very often that there is a capacity of bus and the capacity of the bus, let us say if a normal state transportation bus is there, the capacity is to handle 60 passenger.

But, you many a times see that 80, 90 passengers are also travelling in that bus sometime there are passengers sitting at the top of the bus also. And that means, we are creating overburdened systems. Now, because of these overburdened system, chances of failure of the buses also their

chances of accidents are also there at all 90 passengers get a feeling of discomfort also. So, the overburden systems are also a kind of problem and that we need to eliminate that how do we use a system for which it is prepared.

And the other kind of M is this unevenness, we just discussed about the spikes. So, how to remove this unevenness in your system, how to create a smooth system, which is fitting across the other functional areas. So, that is another important type of issue with respect to Toyota production system. So, these are the 3 M's, Muda, Mura and Muri. So, all these 3 M's are need to be eliminated, we want to eliminate waste from our system, we want to eliminate unevenness from the system and we want to eliminate the overburden less on the system.

And if we can do that, then this elimination will lead to world class manufacturing. This will lead to top organization if you can eliminate waste from your system, if you can eliminate unevenness, if you can eliminate the overburdened on your system, some of the organizations which are in the service sector, like for an example, you have the case of restaurants now in the restaurant, we see that normally the rush hour in the evening starts between 8 to 10pm.

So the restaurants are using the concept of happy hours and by using the concept of happy hours because before this 8 to 10pm if I am talking from 6 to 8pm the capacity utilization is just 20% or 25% but from 8 to 10pm time the capacity utilization may go up to 150 or 200%. So, the entire sitting this filled and there are people who are waiting outside the hotel also outside the restaurant.

So the capacity utilization is excessively high and this is a type of overburdening your system that from 8 to 10pm you are overburdening your system or you can also say that there is lot of unevenness for some time, there are no customers and for some time you have queues in front of your system. So, now by happy hours by reducing the prices for 6 to 8pm you can bring some of the customer from this 8 to 10pm slot to 6 to 8pm slot and by this you may reduce the overburden and you may reduce the unevenness your system may become more smooth.

So by 20 to 25% utilization, the utilization may increase to 50 to 60% let us say and therefore, this 150 to 200% the utilization may come 100 to 110%. So, which is a much better situation

than the previous situation. So, we keep designing, we keep working as per our requirement to eliminate these 3 M's or waste unevenness and overburdening.

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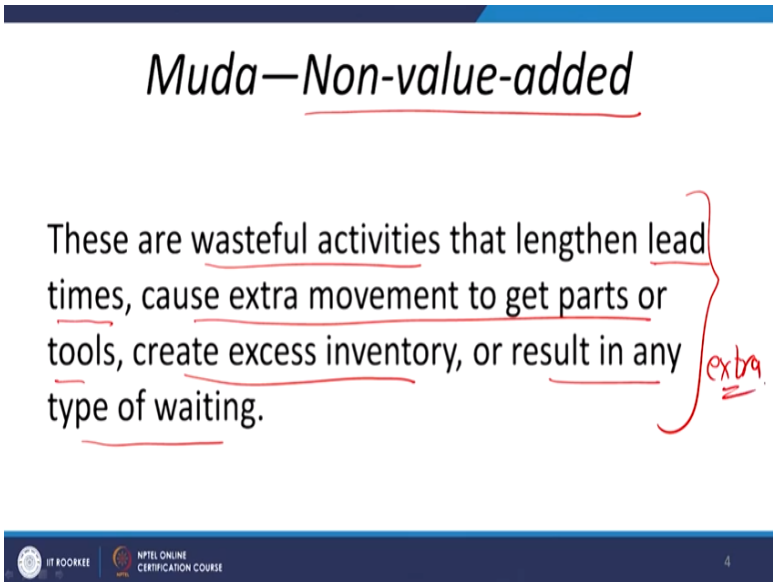

Now, if I say this in more academic language, that Muda the waste is actually the non value added activity. So, these are the wasteful activities non value added activities. And because of these wasteful activities, we have discussed that they result into longer lead times they create extra movement to get parts or tools create excess inventory or result in any type of waiting etc. So, all these things are you see that there is a common word in all these things that extra which is not required, all these Muda related activities are causing something extra, which is not required. So, that extra has to be eliminated. The second thing is Muri.

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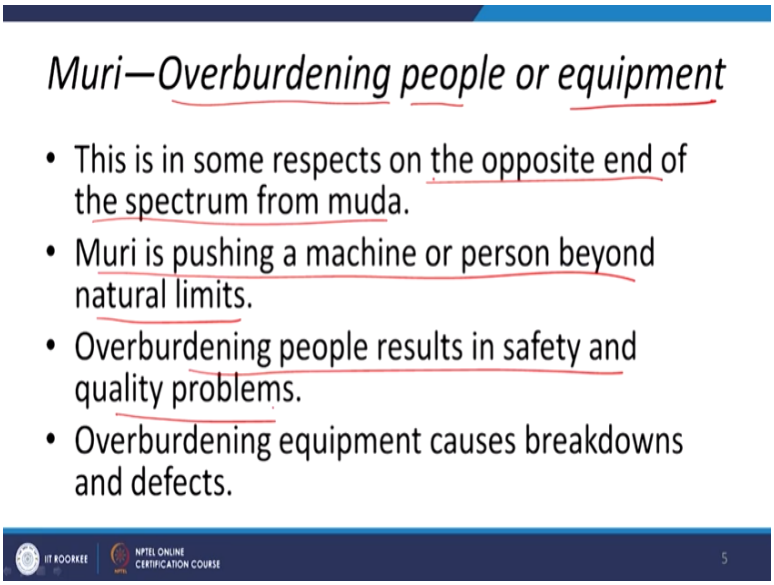

Now Muri is with respect to overburdening of either people or your tools, equipment's, machines etc. When overburdening takes place, you will not be able to give your best performance and that is possible with respect to human that is possible with respect to machines also. Now that is for some of you, it may look that it is the opposite of the spectrum from the Muda. Because in Muda, we are saying that do not do extra things.

So, use each of your resource to the best possible potential. And on the other side, we say that if you are overburdening a resource, the quality may suffer and that is also a kind of undesirable thing. So therefore, if you see initially without deeper understanding, it looks like that these are the opposite and of the spectrum. But if you see closely if you understand the meaning of Muri therefore, we are going on different slides for Muda, Muri, and all these three concepts.

That Muri is pushing a machine or person beyond natural limits. So you can work for 8 hours now I am pushing you for 10 hours that is pushing beyond your natural limits and overburdening people results into the safety and quality related problems and overburdening also causes breakdown and defects in your machines. If a generator can work for 6 hours, 7 hours continuously and if I put that generator in operation for 15 hours, the chances of accident will increase because of high heat generation in that generator and that heat may not be dissipated and therefore, chances of fire may be there.

So, I know that how long I can use a resource whether it is a machine or it is human being without creating any kind of defect so therefore, Muri is undesirable. And the third is Mura that is unevenness that is about the spikes we create in our production output.

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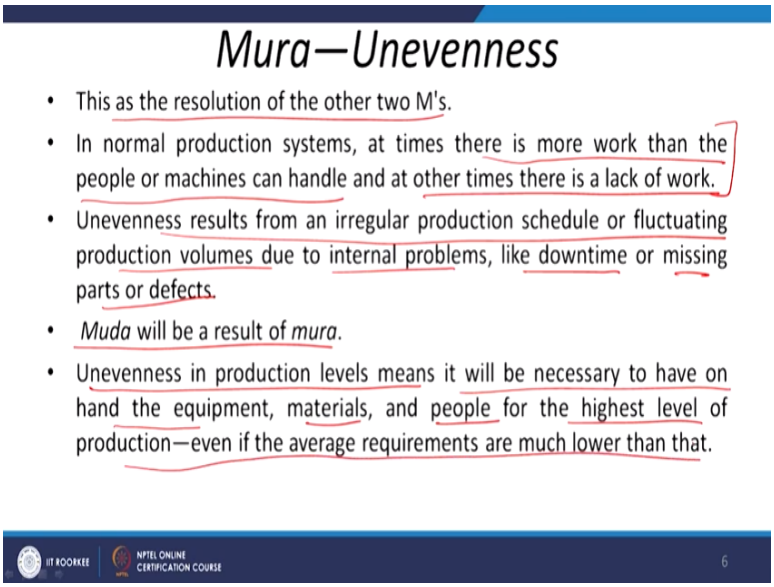

Now Mura is like a resolution of these 2 M's, Muda and Muri, how it is resolution of these 2 M's that in normal production system at times there is more work than the people or machine can handle and at other time, there is lack of work. So, as I mentioned that on Monday, there is no work. So, machines are idle manpower is idle on Tuesday, there is so much of work again going to a service organization.

So, if you go to a hotel, you find that there are more customers on Friday, Saturday and Sunday, because of weekends and there are less customers on Monday, Tuesday, Wednesday, Thursday. So, on these 4 days, you have very less number of customers and on Friday, Saturday, Sunday, there are large number of customers. So, that is a very common thing in all the organizations that sometime you have more number of orders than your machines and operators can handle and some time you have a less number of orders.

So, this results in kind of unevenness so, unevenness results from irregular production schedule or fluctuating production volumes due to internal problems like downtime or missing parts or defect. And therefore, we say that Muda will be a result of Mura the waste which we have

discussed that is a result of Mura because now there are unevenness, unevenness creates different types of problems and different type of problem is create different types of waste.

When you are producing more so, that is creating the waste of overproduction when you are creating more the chances of defects are also there. So, when there is no work, everybody is sitting idle, that is the waste of waiting. So, different types of waste are actually coming from this Mura. So, unevenness in production level means it will be necessary to have on hand the equipment, material and people for the highest level of production, even if the average requirement are much lower than that.

Because if you see this system of the organization, when you are producing in the form of spikes, and on Tuesday you are producing up to 10 O'clock, Monday there is no work vendors there again you are producing all the way up to 4 O'clock and that way, if you find the average requirement of your one week, you will find that you are keeping much more resources to meet your peak demand than your average demand. So, your average demand is much less than your peak demands. So, just to meet out the peak demand, you are creating so much wastage in your system.

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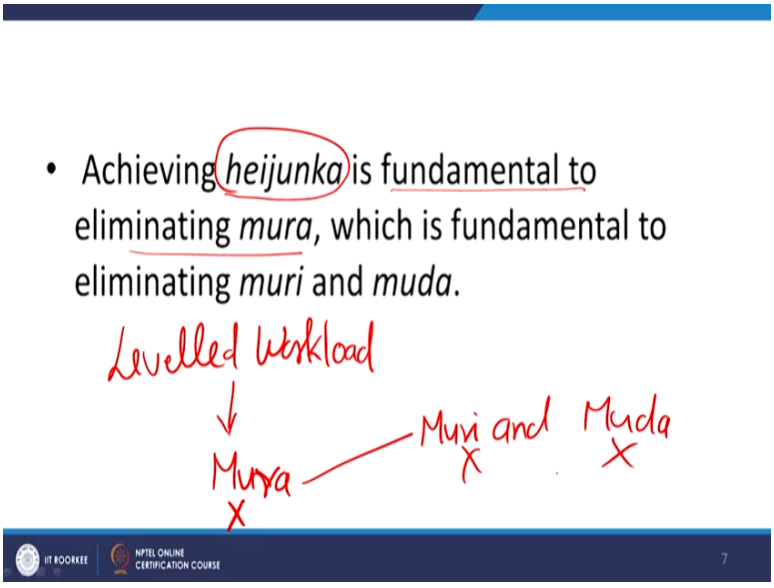

So, therefore, this concept which is a Japanese word, that is heijunka this heijunka is the concept of leveling the workload. This heijunka is a very much fundamental or this is actually the leveling of workload. So, this will be fundamental for eliminating the Mura. So, first with the

leveled workload you will eliminate Mura will go away and then this Mura will help you to solve the problem of Muri and Muda.

So, they will also so, you can say that by following the principle of heijunka, that is the leveled workload that is the even workload on your system that will help us in eliminating the problem of Mura because that is the solution for unevenness. That leveled workload will help us in eliminating the problem of overburdening and the waste.

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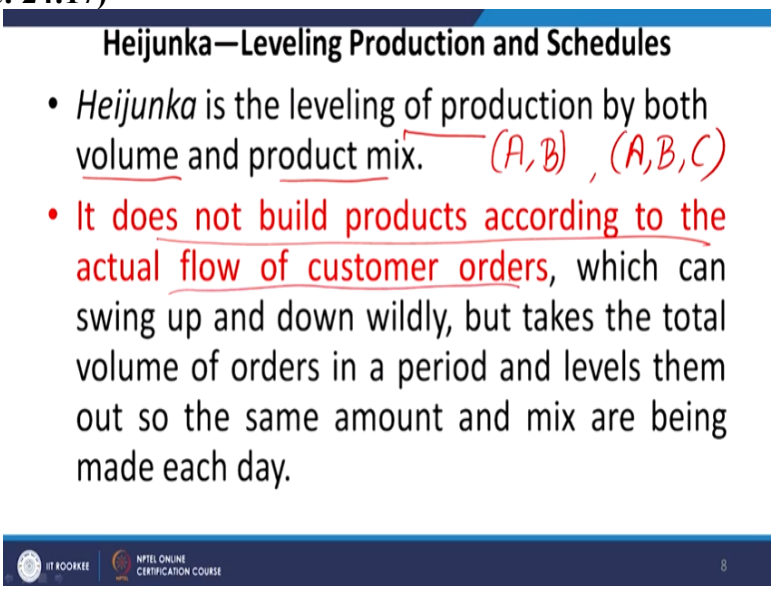

Now, how to achieve this heijunka for that purpose, if you see that, that heijunka is the leveling of production by both volume and product mix, because there are two types of issues one is with respect to volume and another with respect to product mix, because our one plant, one production line produces different type of products. So, there are different requirement of volumes and different types of product mix also. For an example just to discuss, we may have 2 types of products A and B some other company may have 3 types of products ABC.

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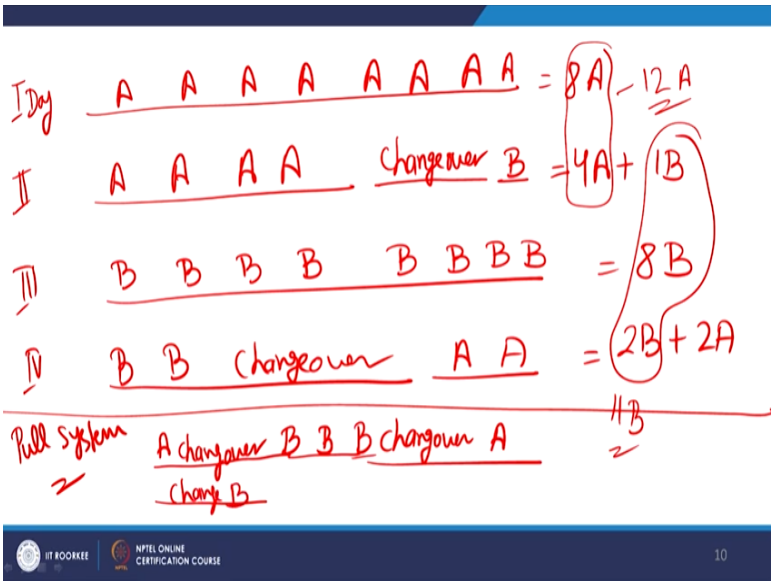

Now, it is quite possible that we may have a production system where you can go for continuously first day all A's are there. So, you are making 8A's on first day, second day you are making 4 A and then some changeover is taking place and then in the evening you could make only 1 B. So, 4A + 1B third day whole day you are making 8B's and forth day you are making 2 B then again changeover and in the evening, you could make 2A's.

So, 2B + 2A now, this type of batch manufacturing is very common that depending upon our production planning departments requirement, so, you have this kind of system that the same toolings will be used, there will be some changeover because of the change in the shape of the product. So, you have different types of (()) (26:47) and fixtures. So, that is the change over time. And now, you see that a lot of inventory you have created, now, you have created inventories of 12 A's. You have created inventory of 8 to 10 + 1 11 B's.

Now, it is impossible to believe that on day 1, there is a demand of only A's and there is no demand of B and on day 3, there is no demand of A and only B's demands are there and if you are producing in such a way that the B which you have produced on day 3 will be sold to a customer who will be visiting next week on the first day. So, you can see now your own that how much inventory of B you are caring for the customer in anticipation who is going to come you after 3 days.

And with this inventory which you are producing on day 1 and day 2, for A you are going to help this inventory for day 3 and day 4 also and you are also not sure that all these A's will be sold. So, this type of problem is there, when you have a type of product mix. So, now we want to develop a kind of schedule where you can produce A's and B's in sync, so that you do not incur excess inventory of any one of those productive.

So, if you have more product that it is really going to help you even in a more interesting manner. So, what it is doing that it is shifting your focus, therefore, this point is specifically highlighted, it does not build products according to the actual flow of customer orders. Which can be swing up and down wildly, but takes the total volume of order in a period and levels them out. So the same amount and mix are being made each day.

That if you see this particular discussion here, if I saying that I am going to make only A's day 1 and few A's and B on day 2, only B's on day 3, this is going to create a lot of problem for me because it is going to be highly inventory oriented system. Now, I have just studied the pull based system, where we need to produce products as per the requirement of the customer. Now, in that what I am going to do in that pull based system that because there is a order of A.

I will produce 1A then another order of B comes I will get into change over and then I will produce B then another order of B is there I will produce one more B another of order of B I will produce one more be then again the order of A comes and I will produce only one A. Next day there is a order of B. So, since the last day a previous day the last product was of A now I will go for changeover first and then I will produce B so this way I am following the pull system. So, every time because of customer orientation, I am now keep changing my production from A to B, B to A and this will create a lot of problem.

So, what I am going to do, I am going to see that over a period of time, over 1 week of time, what I am going to do that I will summarize the requirement of A's and B's and then I will prepare a schedule which will take care that after how many A's how many B's should be produced. And that way I will be able to level out my production. So, this is you can say a kind of intermediate solution between your batch production and between the complete you can say single piece flow system.

So, this is the system which will continuously produce A's and B's also, you will produce A you will produce B after 2A again B is produced. And therefore, for implementing such kind of system you will require a very fast changeover mechanism, if you have all the tools available in that assembly line. So, whichever tool is required for A can immediately be used without focusing and you have to redesign your palates. So that the same palette can hold a same can be hold can be used for holding B also so that will only help us in creating this leveled production scheduling.

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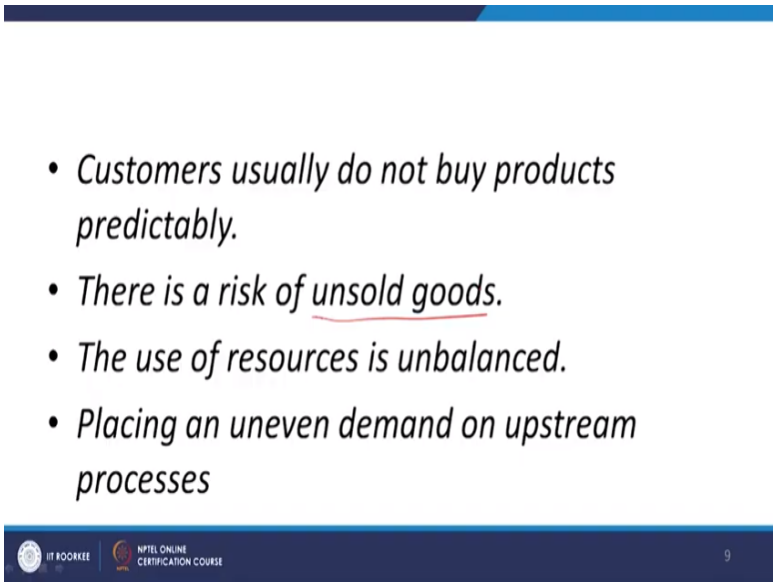

And the advantages if you see that this will help us in overcoming the challenges because there are issues related that customers may not purchase products by a predictable way, there are a lot of uncertainty with respect to customers requirement, there may remain some kind of unsold goods also because if you have produced a batch of 100 products, so there may always be some products, which may remain unsold.

So, because now you have reduced your best size considerably so therefore, the chances of unsold goods will also reduce and the use of resources which is unbalanced because of spike arrangements. So, that use of resources also becomes balanced and the uneven demand because of your uneven production schedule, the uneven demand which you are placing on your upstream to your vendors to your suppliers, that also becomes a smoothen.

So, the philosophy of JIT starts implementing because now you are having a system where the workload is almost leveled. So, that leveled workload will help us in achieving the objective of a smoothening of entire supply chain system.

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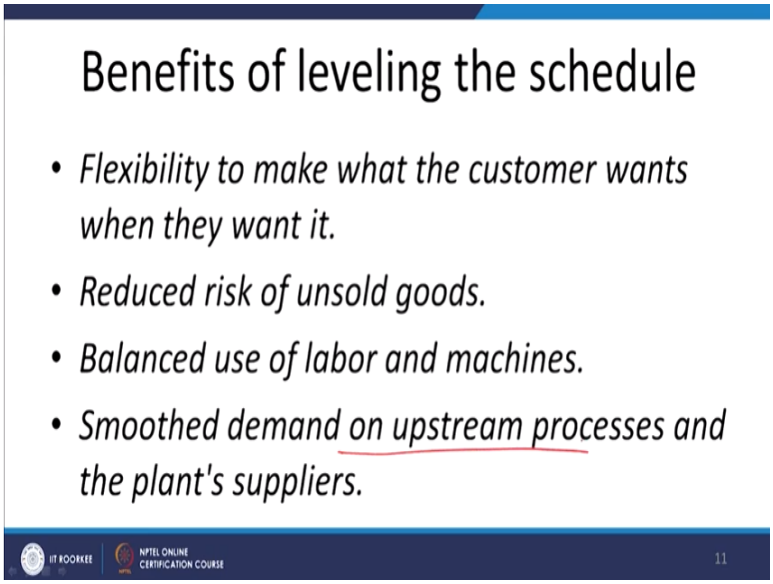

So, that is how we understood that what are the benefits of leveling the schedule you can achieve more flexibility the reduce risk of unsold goods, the balance use of labor and machines and then you can have a smooth demand on upstream processes and the plants supplier. So, with this, we come to end of this important part that how to level your workload and by leveling the workload you can almost achieve removal of waste and you can also reduce the overburdening of your human power as well as your other equipment's. With this, we come to end of this session. Thank you very much.