Manufacturing Systems Technology

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Module – 08

Lecture – 44

Hello and welcome to this Manufacturing System Technology module 44.

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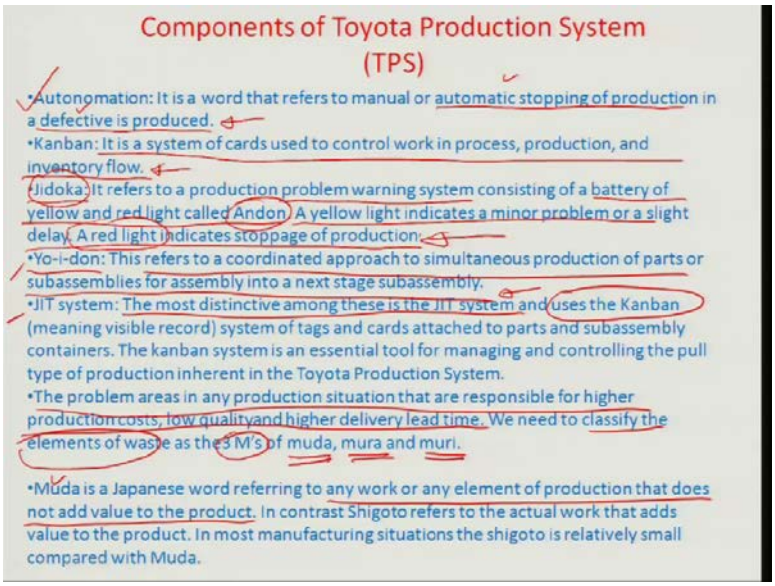

We had discussed in details about the Toyota production system, it is subjective and started discussing some of the components of the TPS including the automation Kanban Jidoka. There are many other such components, which are important for describing the Toyota production system as such one of them is called for example, the Yo-i-don.

So, this refers to the coordinated movement of sub assembly; obviously, the emphasis of a good production system, which is lean managed is that you can make the whole product modularly designed and these modulations or this modularity can be exercised in terms of different sections, dedicated sections supplying the modules together, which come into the main assembly and get fitted in the modular manner.

So, the first essence of the Yo-i-don really starts from the product development stage itself, when you basically look into the, you know the modularity of the whole assembly

process and that is a designed stage. And the moment this design gets realized in terms of production; obviously, there have to be dedicated sections called sub assemblies, which are going to result in some modularity. For example, let us say in a car assembly line if we are wanting to make the door sub assembly as such separates.

So, that is the module which comes and gets added to the vehicle as the vehicle rolls on the assembly line at a certain points. So, when you doing that and let us say if we are actually been able to convert the door sub assembly as a separate entity and there are lot of defects that you automatically can get eliminated just, because of the lesser handling of the door. So, the door is being constructed and added to the material just before leaving the final assembly line and that way you can actually prevent a lot of defects from happening into that section.

So, the Yo-i-don actually refers to a coordinated approach to simultaneous production of parts and sub assemblies. In next model production, this is a problem that you do not have a control on, what is the following module provided one model is already been assembled. And, so therefore, there has to be a plan, which can indicate the kind of sub assembly, which has to be initiated and mind you, there is a whole sub assembly process starting from beginning to end which may be about 10 stations or more, may be in 30 stations or 40 stations.

So, you have to sequence the doors or if you have to sequence the modules that you eventually want to construct in a same manner is the sequence of the variants, which are present in the main assembly. So, the product variants in the main assembly may be 1000 and there may be at a single point of time a completely randomize distribution of let us say 2 of one kind, 5 of another kind, 7 of another kind. So, the sequence has to be obeyed as far as the modularity or the module manufacturing is concerned or the sub assembly manufacturing is concerned. So, there has to be a translation of that sequence.

So, therefore, Yo-i-don is basically a system, which leads to that, that how you can simultaneously produce a sub system. So, that it can in a coordinated manner arrive at the assembly point of the main product as and when we needed that is, what Yo-i-don suggests. Then; obviously, the JIT system, which is the most distinctive among all these systems which are used for the TPS uses this Kanban or use of the Kanban, Kanban actually in Japanese means visible records.

So, therefore, you talk about a system which is sort of making the record of the inventory

requirement visible at different places as a system of tax and cards; obviously, attached to parts and sub assembly containers. So, there are many kind of Kanbans, there can be a production Kanban, a signal Kanban, there can be something related to you know even a lot ordering kind of a situation, where instead of a one component you are having a Kanban card to a lot of different components.

So, there are many, many such different forms of Kanbans, there is emergency Kanban etcetera. And each of them has a certain utility and we will have to in this particular module, in this particular topic, really investigate some of the basic differences that the different types of Kanbans have and how they can be optimize. So, that the production level keeps on smoothly flowing, you know from the beginning station to the end station of the production process.

So, the problem areas in any production situation that are responsible for higher production costs, low quality and higher delivery lead time are sort of classified as the waste in a Toyota production system and these elements of waste are also in short called the 3 M's, where all each and every of this M has a meaning. Typically in Japan or in the Japanese manufacturing system and it is actually a Japanese term also which is used here. The first M is called Muda and I will just explain to you what Muda means, the second is Mura and the third is Muri.

So, these are called the 3 M's and they have each of them has a certain meaning, which I would like to investigate now. So, Muda is a Japanese word referring to any work or any element of the production that does not add value to the product. So, in fact, let us talk about a car assembly for example, if you have committed a mistake somewhere due to, which there is a defective assembly. For example, let us say the seat bolt has not been mounted properly and the seat therefore, one of the bolts are having a cross threads.

So, this is a wastage it is a completely non value added work that is compounded, because you want to make the product good quality and send it to the customer. So, the philosophy is that it should be at the first time produced in the right manner, but because of unfortunately whatever disbalance of the system, which can be preventable otherwise this defect has arise or this defect has arisen.

So, now, the question is that if are we able to really add value to the system by doing this; obviously, it is the necessary evil that has to be addressed, because it is a defect the defect cannot go to the customer. So, this work had it been done before in the assembly

process itself and it would have been very nicely able to get recorded as a 0 defect, it would have given a customer a lot of satisfaction. So, this kind of work has to be eliminated, that is buy and large the vision of the Toyota production system.

In fact, the useful work in Japanese languages called Shigotho and the idea is of the Shigotho should always be more than the Muda and shigotho should be much, much more than the Muda. So, of the useful part of the work, which is adding value to the system should be the more prominent and the waste part of the work which is otherwise not adding value, but is the necessary component, because of whatever defect has happened or whatever process flow has happened is called the Muda, which gets carried forward as the lost to the company.

So, the tightness of the control is; such that the Muda is eliminated to the maximum possible at all extents in the assemblies and in the, you know even at the sub assembly level, so that is Muda.

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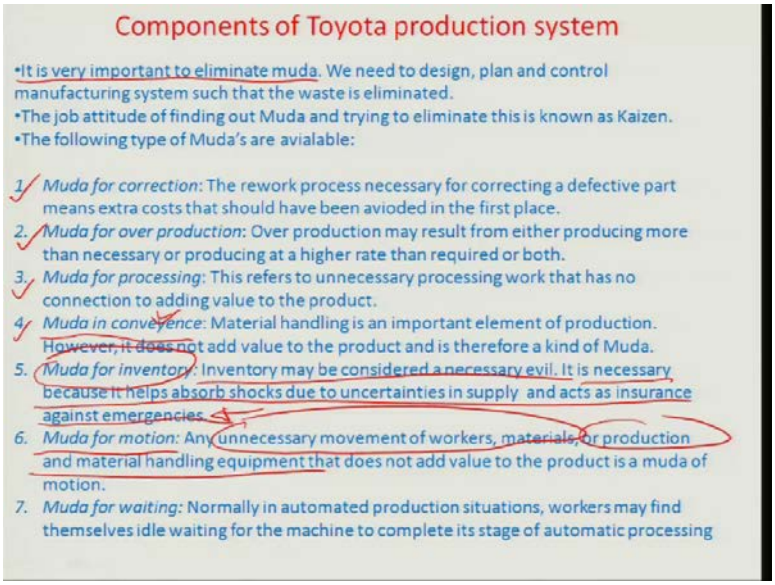

Unfortunately if you look at a manufacturing system if you go through almost always very low in comparison to the Muda and you will have to sort of crisscross it with the Shigotho going up and Muda going down, that is what you are management activity should focus around. So, there are many kind of Muda, so if you look at into the various kind of wasteful activities which are there in a system; obviously, we need to design plan and control such Muda's.

So, there can be a Muda for correction for example, as I was mentioning the rework

process necessary for correcting a defective part; that means, extra cost that should have been avoided at the first place. So, this is the Muda for correction or repair, there can be a Muda for over production. So, it can either be resulting from you know producing more than a necessary or producing at a higher rate. Sometimes, you know people would be in order to protest against the some management decision, we unable to work at a higher rate and produce more.

So, there they want to disbalance this whole fine line of system. So, that should be controlled at the first instance, the harmony with which the process has been designed should be at no level sacrifice and there should be the exact flow rate which the process is supposed to our balance to handle continued throughout the process. So, the management role here in the TPS is really to look that there is no over production at any particular point. Person should not work harder or work sort of a, you know at a higher speed to overproduce.

There are many flaws if that happen first of all if the person is giving less time to the per unit production there may be a issue related to the quality of the product the quality make go down, because of the less time and there may be defective part produced, which are in any event going to create disbalance in the whole the process flow. So, by and large you need to eliminate the Muda for over production Muda for processing of course, this refers to the unnecessary processing work.

For example, process can be made simpler by probably time and motion study and if that has not been executed properly there can be repetition of a step, which is otherwise wasteful. So, there has to be a very critical analysis of each and every motion study related to the personal, who have deployed in a particular product assembly and that can be with the most modern ways and means of visual communication be able to get eliminated.

Obviously, that happens, then the Muda for processing that is the unnecessary processing activity, which otherwise could have been eliminated gets removed from the system. So, overall there will be a highly productive system if such wasteful motions are identified the minutest levels and try to eliminate there is a Muda in conveyance of course, which means that the material handling is an important element and that has to be somehow minimum, because for example, the truck loading unloading may take place close to the material location where it is going into the assembly line is big question.

So, how will you route the trucks in manner throughout the company. So, that an how will you for example, make a short storage or a temporary storage very near it is a sub assembly or very near its assembly into the final product that route planning is, what would eliminate the Muda in conveyance by any chance we should not make a material handling difference by making a elongated root of the material before it get sub assembled or before it get fitted into the main product.

So, you should try to minimize the distance in terms of it is storage location and in terms of supply location, so on and, so forth. So, that is the Muda in conveyance, then we have Mura for inventory may be considered as a necessary evil so; obviously, inventory is a very much needed, because sometimes there are shocks because of defects produced or because of some disbalance, which has to be somehow absorbed an inventory is the absorption bed for such shocks in the smooth flow system otherwise.

So, you have to have a correction there for the inventory you should maintain the inventory level by and large to the leanest and this is a part or essence of the JIT system itself there, how the inventory will be at the leanest level or maintained at leanest level. So, it is necessary because it helps to absorb shocks due to uncertainties in the supply and acts as insurance against emergency although you have to eliminate the extra inventory at all level. Then, you have Muda for motion and this relates to the unnecessary moment of workers and materials or production or material handling equipments.

For example, in a shop floor particularly in a car assembly there may be a the automated guided vehicles, which are the tracks are designed in the manner to sort of handle the trolleys or the bins and automated take and supply to the location that they are used for or the location that they have to be fitted in. And, so in that route planning one has to have the optimistic view that whatever is the closest location of the stock that should be used for routing the to pick up the material and going to the sub assemble level. So, that minimal amount of movement is there.

Similarly, the same thing otherwise can be done by a human being of moving the material from its stock location to its fitment and there is also a lot of Muda that can be a eliminated in this particular process. And, so is the case with the you know the production and material handling equipments particularly sometimes the repair equipments needs to be in place at the right amount in the right quality and the right

levels. So, that you do not need to really have time delays, because of such equipment being in place.

So, therefore, there can be Muda for motion, which can be eliminated for almost all the cases and then finally, the Muda for waiting, which is normally in automated production situations, where workers find themselves you know idling at certain place, because the previous station is not been able to complete the job. So, by and large this kind of a wasteful activity a time delay and the balance against get deharmonized, which should be avoided. So, if there is a situation like that there should be immediate addressing and there should be immediate cancellation of that Muda for the waiting.

So, that the unnecessary time gets killed an there immediately supply the worker with the next particular item, which can work in. So, that it does not need to idle at that particular stage these are the different kind of possible Muda or wasteful activities, which need to be eliminated, when we are talking about Muda in a Toyota production system.

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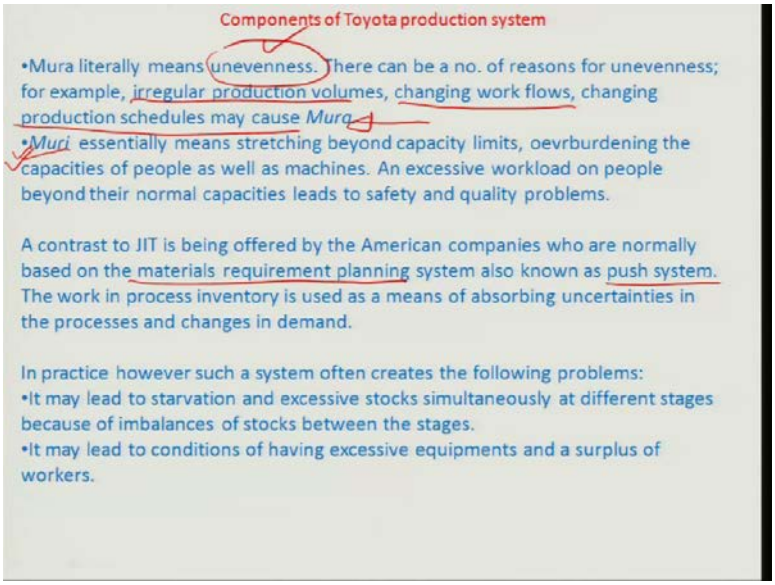

So; obviously, as Muda there is Mura, which literally unevenness, so as I told you that is a harmonized situation in any kind of disturbance or disruption in the flow of the material would lead to this unevenness this can be irregular for example, production volumes it can be changing work flow patterns it can be changing production schedules. So, all these may actually cause a Mura to happen and this has to be avoided the Mura the unevenness has to be avoided by and large it has to be a smooth balance system.

Then; obviously, Muri, which means that, stretching beyond capacity limits or

overburdening the capacities of people as well as machines. Obviously, if we are giving more work load to a person and not really enough balance, then he is going to produce defective parts and the defective parts is also going to result in a Mura, which is basically the disbalancing or even many wasteful activities like repair etcetera, which is a Mura.

So, Muri is basically the one of the keys that needs to be addressed that give work in a manner that it is capacitated to a person to the extent that he can deliver and do not overburden the particular work center or overburden the particular person. So, that he can actually do his work in a qualitative manner at the right you know mind frame and he can also provide a overall good example for his for his successor. So, that the successor also sort of maintains that is same culture or harmony across.

So, Muri is the essence of all these which has to be really the key for a Toyota production system process that this work balancing or the work you know assignment has to be justified in terms of a human being capability. Obviously, here is, where a large philosophical difference comes, because there are people, who are very hard working and there are people, who cannot work in the same manner or there may be problems related people.

So, the proper identification of the personal is also very, very important and beyond that proper identification the question of whether the deliver ability will be there are some misuse factor in between that also needs to be planned. So, this is more of a and then also train ability of the person that how fast the person can learn in certain work station is also very, very important. So, these all essentially mean the Muri and this Muri has to be addressed at the very beginning when you do the line balancing or when you do the worker or worker assignment or people assignment personal assignment to a particular job.

Obviously, a contrasted to the JIT system is offered by the American companies, which are ah known for the you know the Material Requirement Planning or MRP based push system as they call and the work in process inventory is used as a means of a absorbing uncertainties in the process and changes in demand which is actually now, operating at a very, very high you know inventory level. So, in practice; however, such a system often creates many problems including starvation and excessive stocks simultaneously at different stages, which may be very difficult to again you know balance in terms of the whole process balancing there will be a huge problems in such starvation or

excessiveness happens.

It may also lead to conditions of having a excessive equipment and surplus workers which is again a major issue. And, so; obviously, it has its own advantages, but the American system by and large is more resource and intensive and the lean manufacturing of the Toyota production system that we have studied, so far is less resource intensive and that is one of the major differences that it is more a economized manufacturing I would say that is followed if you really closely look at, what TPS system has established or TPS system is for.

So, I think I am going to sort of finish sort of finish this particular module with the little more you know knowledge to be imparted before we actually start to do the Kanban based designing for such a system. So, we will do that or continue that in the next module.

Thank you.