Manufacturing Systems Technology

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Module – 08
Lecture - 46

Hello and welcome to this Manufacturing Systems Technology module 46. We have been talking about production and withdrawal Kanbans in the previous module and we also discussed about the way that cyclically you can flow both of them in a manner. So, that the overlaps of the times between the flow on the right and the flow on the left of the production and withdrawal would actually ensure that you have minimal possible inventory.

We also made a statement, very bold statement last module where we talked about that the JIT really aims for one bin inventory level, although it is practically not very realistic, but if this approach which is actually indicating the lean inventory at every stages followed. Overall there will be definitely a sizable amount of inventory reduction, which would be able to benefit the system as such. So, I was last time referring to, you know the way that we can calculate the active number of Kanbans in a system.

So, that it can ensure that the system goes trouble free without any break downs or without any stoppages. So, we need to sort of evaluate that part today, a quick recap of what would happen.

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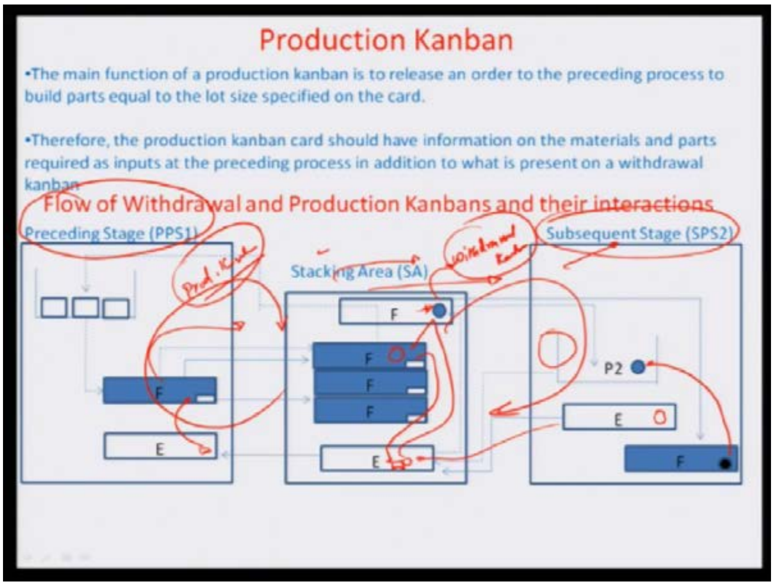

So, this is the production side of the Kanban as had been illustrated earlier. So, you can see the production Kanban take this bin F all the way to the subsequent processing stage, the card is removed and thrown in this container here, till and till the full bin becomes empty and so another empty bin with another card which was actually suppose to be in a full bin, this is actually a circular card. So, this would go as a full bin.

So, as you can see here from the stacking area, the full container containing a withdrawal Kanban, the circular card write about this particular place, this is withdrawal Kanban goes to the subsequent processing stage SPS 2 and then, moment the full bin goes here, the card is removed from the full bin and kept into this particular rack p 2 and another empty bin has the same, you know card put in place actually and this travels all the way back to the stacking area, as you can see here.

The moment this comes again you now this circular card actually goes out of here and is able to record on a full bin. The moment the circular card enters a full bin, the rectangular card goes here, the rectangular card is basically the production Kanban and this initiates the empty bin to go into the previous processing stage or the preceding stage PPS 1 from which again a full container can be started by changing the rectangular card to a full bin at the preceding stage from the empty bin, which it has received and subsequently the empty bins can be process.

So, there is a flow of the rectangular card which is the production Kanban towards the left. So, this cycle here which is going on is the production Kanban and this cycle, which is going on here is the withdrawal Kanban and that is all about the balancing at the overlapping the various time which leads to a reduction in the stack area.

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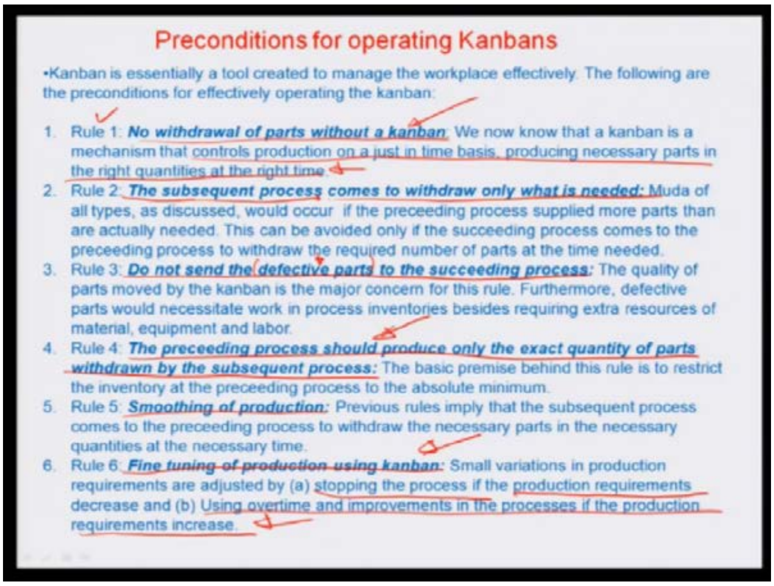

Some of the rules which are important for these Kanban flow to happen and which has to be followed are the following. Rule 1 is that no Kanban or no withdrawal of the parts can happen from the stocking area without a Kanban going into it. We now know that a Kanban is a mechanism that controls production on a just in time basis producing necessary parts in the right quantities at right time. So, therefore, there should not be any overproducing or overflow of materials at every stage, apart from what has already have been dictated by the Kanban cards.

The subsequent process should come to the, you know the previous stage to withdraw whatever is needed. So, it should not overload itself by giving a requirement which it cannot be able to process, that will do the line balancing disturbance, the disturbance for the balancing of the whole flow. And so Muda for all types that is waste of all types would be eliminated in this manner and if supposing the preceding stage is able to give a defective part, then there has to be a mechanism in place which I will come to later which is actually known as the emergency Kanban, which will try to initiate the process flow back to normal see.

But, then that would be again recorded somewhere and based on that, the upper management can take a decision about the counter measures etcetera as to why the defect at come in the process, because of which this emergency Kanban had to be released. So, subsequent as a process stage comes to withdrawal only what is needed that is rule 2. Rule 3 is do not send the defective parts, by enlarge you should be able to give a total quality management at your respective work station and you should not be in a situation to produce defectively, plan your systems at the work station in a manner.

So, that there is a 100 percent fitment of the assembly or there is a 100 percent deliverability of the work that you have planned for that particular station, the station has to be loaded in that manner. So, that the guide does not have an overload or the person does not have overload and based on that, he produces high quality. So, therefore, do not send the defective parts in any case; obviously, there is a mechanism in place which should be going through a lot of Ringmer holes to actually balance the line again if a defective part is produce so, better not do that is the message that is given.

Rule 4 is that the preceding process should produce on the exact quantity of the parts withdrawn by the subsequent process which; obviously, means that without a production Kanban going into the preceding producing process, the production process it should not get started on it is own and it should not overproduce. So, in order to maintain the balance it should already read the card, the Kanban card coming from the stacking area and we able to deliver whatever has been given.

So, in fact, when we are talking about large automotive assemblies where they are many vendors, the Kanban has to be implemented all the way to the vendor end, where therefore, if supposing something is fitting on the line there should be a real time information of that on the vendor end. So, the stacking area just about gets balanced you know, it is not that it has a 0 stacking area, but the goal of completely you know completely full proof JIT system would be one bin which is probably not possible.

But, even if there is a miniscule level of number of bins which are there, the vendors should be balancing the stack area on one side through the production Kanban, which is released by the stacking area. The operator on the line, who is consuming that should be balancing the stacking area by producing the withdrawal Kanbans from time to time. So, that it does not get over stock. So, this harmony this process balance has to be maintained.

Rule 5 is smoothing of the production; obviously, the Kanban system cannot operate in a situation when the, where the production is to there is a lot of variation in the overall production requirements which are there. So, by enlarge the system is more implementable in a situation, where the demand is more or less similar and somehow this is what the customer end of the organization has to ensure that the demand which comes in has to be planned in a manner. So, that there is a very good flow within the organization.

Obviously, there are many issues in that whole way that this chain is setup from the costumer to the manufacturing process. But, by enlarge the smoothing is something that is needed to maintain an inventory less system as Kanban and etcetera. So, if you are in business, if your product is doing well Kanban can be very well implemented, but if there is a sudden change in the demand pattern or a shock which comes to the system, it may be able to disbalance the system completely and that is something that you should not aim for when you are talking about Kanban systems or lean manufacturing implementation.

So, fine tuning of production using Kanban is another big issue, which needs to be addressed here. So; obviously, at every stage of a production process beat the assembly stage or in automotive. For example, beat the paint stoppage or the press stoppage or beat the well stoppage, whatever it is the Kanban has to be very well tuned to each processes and it should go root back to the, you know the root processes which are typically at the subassembly and sometimes even at the vendor end.

So, that tuning has to be the tunability of the Kanban system has to be there as regards all the overall production and small variations in production requirements can be adjusted sometimes by stopping the process, but still maintaining that Kanban concept. Even if the processes start at sometimes, you may create the small, small variations to see if you know how quickly the Kanban can arrive for ensuring a smooth flow in the process.

The moment there is some kind of a stoppage, because of some material stoppage at some area and using overtime and improvements in the process if the production requirements increase, you should always ensure that once the Kanban has been fine tune it should be maintained at all by all means. So, that is what the some pre conditions there are, are using the operating Kanbans in the system.

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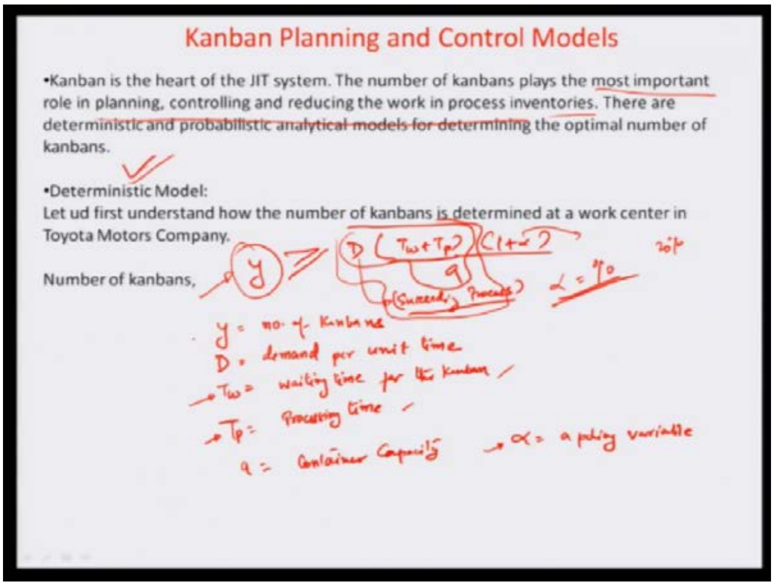

Now, I am going to sort off go ahead and do some calculations here, where we can estimate what are the minimum number of Kanbans which you know can play a major role in short of planning controlling and reducing the work in progress. And; obviously, there are two approaches for estimating the Kanban level, one is more on the deterministic side which talks about the exact numbers of Kanban and another is on the little bit probabilistic side, where there is a cost minimization which is involved in estimating the probability of having one or the other level of Kanban in the systems.

So, let us actually talk about first the deterministic model and in this model typically the numbers of Kanbans let us say we call it y at a certain time let sat y is the number of Kanbans and let us also say that D is the demand per unit time; obviously, T w is the waiting time for the Kanban and T p is the processing time for the Kanban you have to now understand the withdrawal in production cycles in terms of these times. Because, these are something's that you have to make an observation and you have to calculate for a given situation processing time. And a being the container capacity; that means, you know whatever number of parts are coming in one bin or one container and we also introduce a policy variable here, which is actually the shock observant mechanism that you have in place in a Kanban. So, you can all ways over plan a little bit or you know lesser depending on what is the regularity of your supply schedules. So, your basically try to vary this alpha to minimum possible to have a overstocking situation or even a zero overstock kind of a situation.

So, you will have to now study very carefully your process in see what works out for you in terms of alpha. So, therefore, this y can be estimated as greater than or equal to D the demand per unite time times of you know how much waiting an Kanban processing time is involved times of this 1 plus alpha which actually over stocks the situation divided by a. So, this is actually really the number of you know containers which are a commutating all the waiting as well as the processing time for a certain demand and the demand is dictated again by the succeeding process.

So, basically this is coming from you know your station which is prior to you from the customer end. So, succeeding process, so that is the demand and so the demand times of the wait period is really is the number of the demand per unit time times of the waiting time is really the number of items which are going to be there to make a balanced kind of situation as per the requirements and that is divided by a is; obviously, the number of compounds per container make set the number of containers.

Alpha is as a I told you the policy variable which over stocks, because if a alpha is mention in mostly in percentage. So, if this alpha is let us say 20 percent extra so; obviously, your above of the demand which causes the balancing by multiplying that with 1.2 meaning there by that there is a overstock situation, there is a 20 percent overstock which actually gives you the determined value of Kanbans and Kanban is in that case 20 percent higher because of supply regular irregularities etcetera, which planed for a certain process.

Now, mind you this is a calculation which goes up to the every you know every single sub assembly stage or every you know stage it up to which it can be implemented or up to which can be doable. So; obviously, the philosophy here is that you have to really take it to a level at a single process level for example, where there is some kind of input for in terms of raw material which is coming and some kind of output that the process has that process can be at the vendor and even, but if Kanban has to be in totality implemented it has to be at that particular level of brake down of the you know the whole structure. So, at the fundamental, most fundamental manufacturing process level, so going up to that.

So, let us look at a sort of a example problem that we have in question, where we talk about determination of a number of Kanban deterministically as you have seen before.

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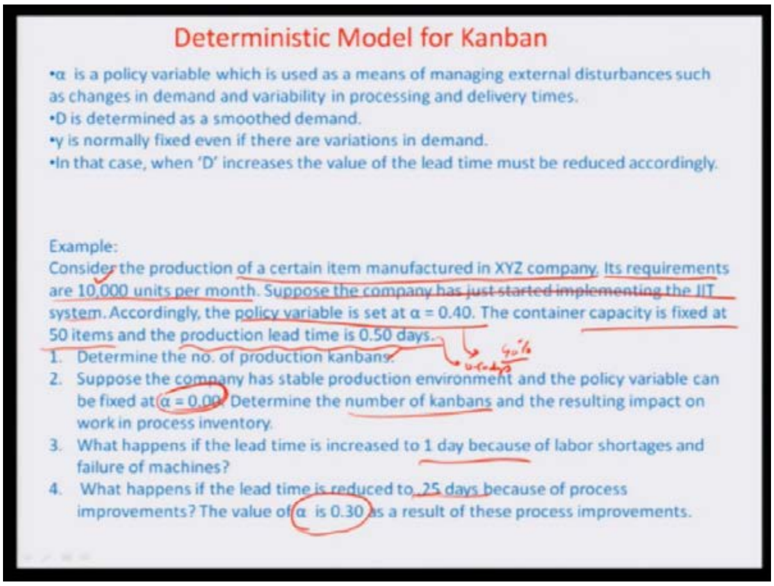

So, let us consider a production of a certain item manufacturing in x, y, z company and it is requirements are about 1000 units per month and supposing the company has just added implementing the JIT system an according to the situation the policy variable now is set at about 40 percent. So, therefore, about 40 percent highest stocks are needed every looking corner over and above what the JIT system promotes you do have and the container capacity now is fixed about 50 items per container and the production lead time that you have is about 0.50 days that is what the production lead time.

So, you want determine the number of production Kanbans, now he is giving certain other cases for example, supposing the company has a stable production environment and the policy variable can be fixed at about 0 that means no overstocking situation. So, in that event you can determine how many Kanbans would be needed and what would be the resulting impact in the working process inventory.

Obviously, he is talking about other shockers for example, what happens if the lead time is increase to one days, because of one day because of the labor shortages and failure of the machines or if supposing it is reduced, because of some higher productivity causes and issues up to 0.25 days and because of some process improvements that you had what would be the number of Kanban in that situation and there you to assume; obviously, a lower value of the policy variable resulting from this process. So, let us actually address these one by one and try do see what we get in.

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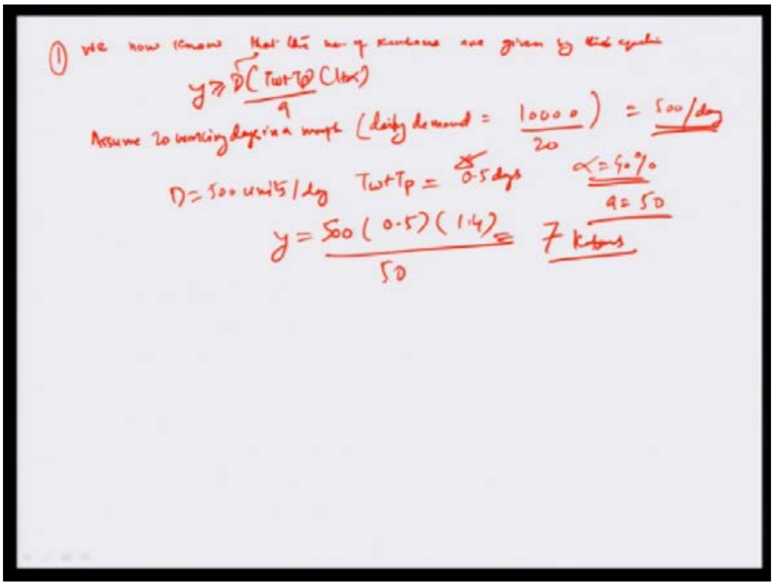

So, we now know that the number of Kanbans are given by this equation y greater then equal to D times of T w plus T p by a times of 1 plus of alpha. So; obviously, here the daily demand which has been described in the question has been given as about 10,000 units per months, so if you assume about closed to you know 20 working days in a month. So, I can estimate the daily demand has whatever it is gets produced in a month divided by the number of days which is about 500 per day. So, we would estimate this on per day basis; obviously, the demand that is available is in per in a days.

So, the demand here D what is comings is about 500 units per day has given in the question. And the total amount of production time, which is needed which is actually resulting from the both the waiting period and the production period of the Kanban that is given to be 0.5 or half day as a illustrated in this question here, so production lead time.

So, then the number of Kanbans that we should have should be actually exactly equal to are even more than the, at operating policy variable alpha 40 percent which is over stocking the situation. The total amount of you know Kanbans which should be really in place are 500 times of 0.5 which is actually this production lead time times of the over stocking situation. So, you have planning 40 percent extra divided by a is the container capacity in this particular case, the container capacity has been given to be 50.

So, that is how the number of Kanbans result and in their exactly about 7 Kanbans which needs to be in place for smooth flow of the systems, so that is how you basically operate this Kanban calculation or deterministically you determine what is the number of Kanban levels. So, I am going to close on now, because in the interest of time the module time is; obviously, over the next reaming portion of this particular problem can be addressed in the following modules till then good bye.

Thank you.