Manufacturing Systems Technology

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Module – 08

Lecture - 45

Hello and welcome back to this Manufacturing Systems Technology module 45.

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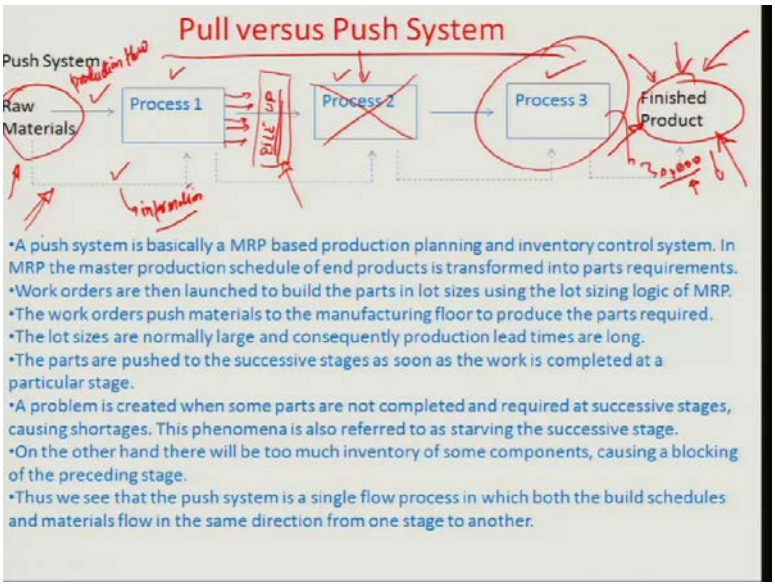

We were discussing about the Toyota production system and some it is components and we mention that it is different than the American system, the MRP Material Requirement Planning base system, which is more a push base system. So, let us today in this lecture first try to have a schematic look out on what really we mean by pull and push systems. So, here you can see there are different processes in a particular assembly or sub assembly of a product and at the end, there is a finished product here, but it goes through process 1, 2 and 3 and there is a flow, continuous flow of raw materials from one side which leads to the different processes and finally, gives the finished product information.

So, there are two different kind of lines that you can see, one is the solid line here and there is another dotted line, a solid line actually means the production flow and the

dotted line means the information flow. So, basically what happens is that in this kind of and this is called a push base system, because this system is governed by a certain plan which has been made for a time horizon for looking at the market, looking at the you know the customer inspiration and wants and the probably the marketing has suggested that so much product of a certain type x can be absorbed by the market.

So, over a period of let say 15 days or 10 days or may be even 30 days. So, there is a planning horizon which is there and the marketing has suggested these requirements and based one that now all the subsystem level requirements are generated or all the small components, which would typically go in to sub assemblies which would again modularly go into the final assembly they are generated. So, this generation is spread as a production plan all across the whole organization with it is various departments and divisions making different modules towards the final product.

Then, because of this plan there is a requirement assessment and there is a material buying or inventory buying, which formulates all the way to the vendor and now this material has a lead time aspect, it comes in and now it is ready for the production to begin. So, once this is happened, the material as well as this information is forward post from the raw materials stay to process one. Now, what are the problems associated with such a push based system that is why it is called pushed base. So, you are pushing the material from the, in the forward direction all the way to the finished products.

Now, supposing there is some snag in the process 2 which happens, because of which the process 2 stops producing the particular, you know the particular component at this particular level. So, if the process 2 is stop producing; obviously, the process flow happening from process 1 is still continuing, there is no stop to that flow, because you are driving the process 1 on the bases of the push system, which already has a planning horizon defined and therefore, there will be a pile up.

Because, the process 2 is not able to absorb any more and the process 1 is still sending the material, so there is going to be a pile up. So, this is a natural consequence of a disbalance which will happen because of the defect of the process 2. Obviously, in that system then you will have to really make sure that the process 2 comes to normalization within minimum possible times. So, that this pile up is reduce etcetera, but whatever you are doing here is very, very waste full.

Obviously, then another issue is, that at the end of the process supposing you are produced 30,000 parts based on the planning horizon and supposing in between there is a need change or the aspiration change of the customer and the demand suddenly falls done, then what you do with this finish products. So, this is either all made shelled and the right of marketing opportunity being initiated for selling them off or in other words, if that does not happen then the only other situation is that you have describe some of the product off or may be just retranslate that back into another aspiration or another needs.

So, you will have to make the additional work of disassembling things and trying to have some of the components to suffice. Normally the companies do not do that was the product is produce, they will either shelf it if not needed and then, wait for an opportune time to give it to the customer. But, then this buy and large suggested the system, where there is many chances of flaw or bottleneck as for as the intermediate processes are concerned or as far as the costumer need mapping or customer aspirations are concerned.

So, this is generally the disadvantage with the push base system, which continued before the TPS of Toyota Production System came into the process and in fact, TPS for the first time showed that this push system can be completely converted into a lean pull system, where it would be the customer requirement that would be mapped at every stage and the information would come based on that particular requirement.

So, you need not really over produce and if the expectation changes and there is a need map which is different from for certain time horizon and then suddenly is able to change within that you know horizon to some other direction; obviously, the production flow will also change in accordance with that and then may be minimalistic stock at different levels, because of that need change or need mapping change. So, that is how a pull system would work out.

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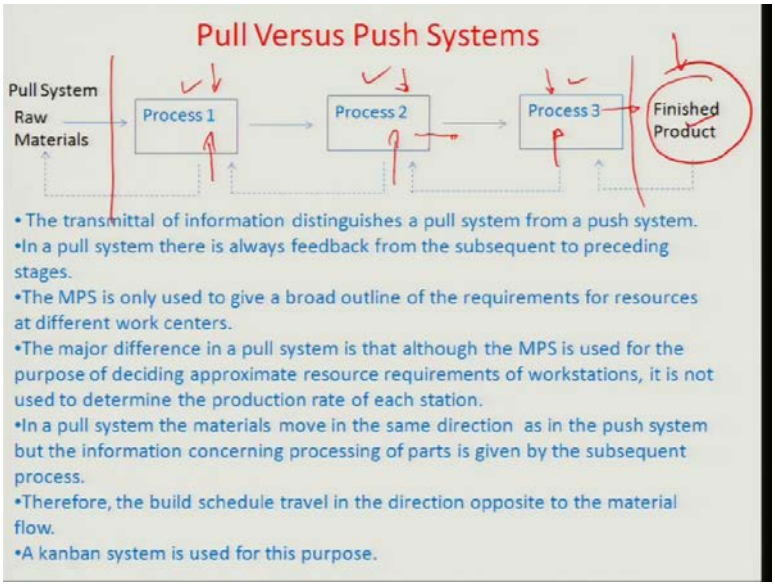

So, now you have finished product which is done by the customer in terms of a requirement and this requirement now starts to go in the backward direction, you have maintained a stock in between all the processes 1, 2 and 3. So, that you can address if the process and that is the reason why assembly lines, they are broad in that. Assemblies are basically having a work in process inventory which is semi complete and the line would go at a certain rate of the expectation and aspiration of the customer.

So, therefore, the customer has given a plan and based on that plan of his requirements or aspiration, the product information goes back to the process 3 which already has a semi finished inventory and is waiting for the customer order, the whenever the customer order comes the process 3 finishes the particular work in process and sends it is product to the customer and simultaneously, orders for again some part from process 2. So, that it can augment the vacancy or void created in the process 3 so on and so forth.

So, now what is happening is that the information about the requirements is really flowing in the backward direction and the production is flowing in the forward direction and there is a complete need mapping now. So, wherever there is an aspiration change on a real time, you would be able to change this information flow. So, that exactly what is needed is delivered and then the processes are definitely made flexible enough. So, that they can suddenly change to this business pressure or business environment and that is all about the design of the system in place.

Obviously, it cannot be really a real time change, there are limitations the individual level processes have to be change. It will take some time for changing the process also, but the whole idea is that can it be quickly arrested, so that there is minimalistic pile up in between and that is how the philosophically this system is designed. And therefore, you have a information flow in the backward direction and production flow in the forward direction, which represents the pull based system.

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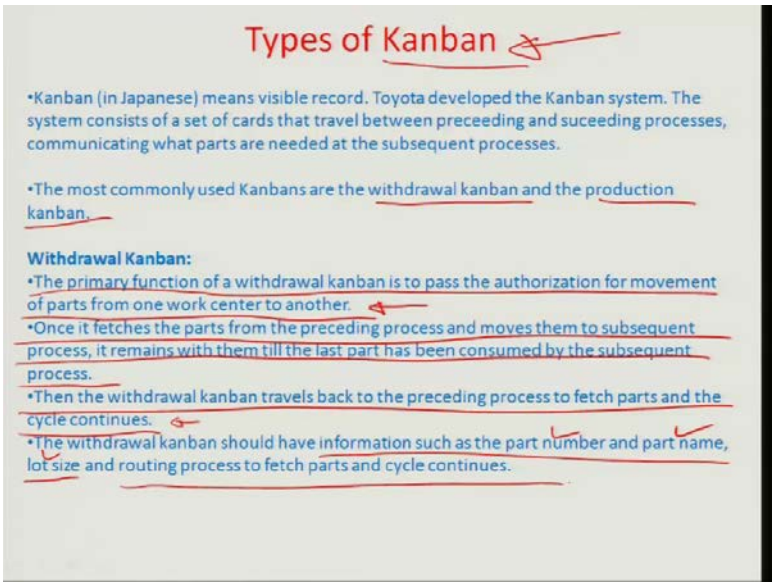

So, there are many advantages of a pull base system and there are many modalities of a pull base system. So, advantages I think I have enumerated a lot now, now let us look at some of the basic engineering modalities associated with designing such a system. So, the central tendency or the central requirement of such a system is the information flow and the information flow happens through this particular, you know item here which is known as Kanban on our visible record, which talks about how much material between what process to what process at what particular time and what is the type of the material in one single go.

So, there are normally two different kind of most commonly used Kanbans or cards, Kanban cards. One is called the withdrawal Kanban and others called the production Kanban and I am going to now individually start designing the system with respect to the withdrawal Kanban and the production Kanban. So, you can see that the primary

function of a withdrawal Kanban is to pass the authorization for movement of parts from work center to another.

Once, it fetches the parts from the preceding process and moves them to the subsequent process it remains with them till the subsequent process has consumed the particular part and when the consumption is happened only then the withdrawal Kanban has to travel back preceding to the preceding process to fetch equal number of parts which have been consumed and the succeeding process and the cycle keeps on continuing.

So, Kanban card releasing the material to the next station, the next station consuming that material and then releasing the Kanban card back to the previous station and movement the Kanban the previous station gets the card it is start to produce that particular material and sends it a head to the center two or the succeeding center and the cycle of the card and the production flow keeps on continuing for a lean inventory mountainous between two stations.

So, with the withdrawal Kanban it should have the following information should be typically what is the part number, what is the part name, what is the lot size and the routing process that is needed to fetch the part and these all are given as a part of the information on the Charlet describe our Kanban card really looks like.

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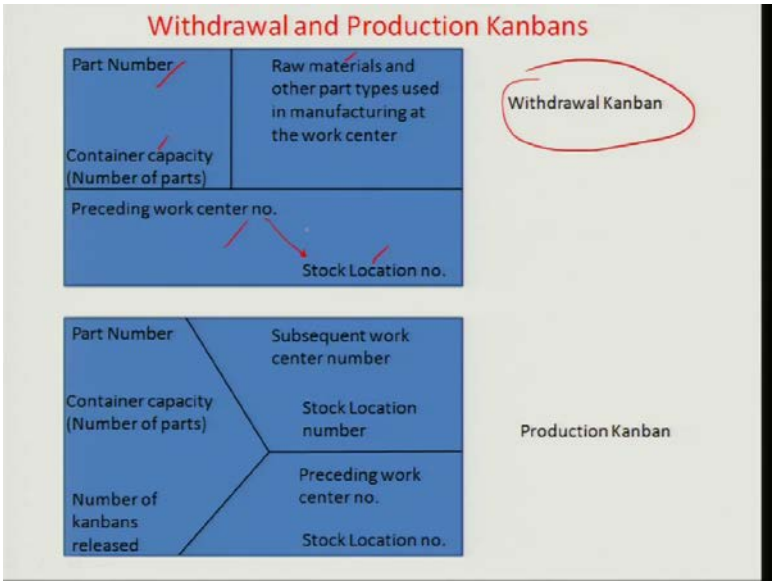

So, this how a withdrawal Kanban looks like you have raw materials and other part types use the manufacturing at the works center you have the container capacity, which gives you number of parts this is a part number we will describes, what the part is and also it describe what is the preceding works center number and what is the stock location number for this particular work center number that this card has to going.

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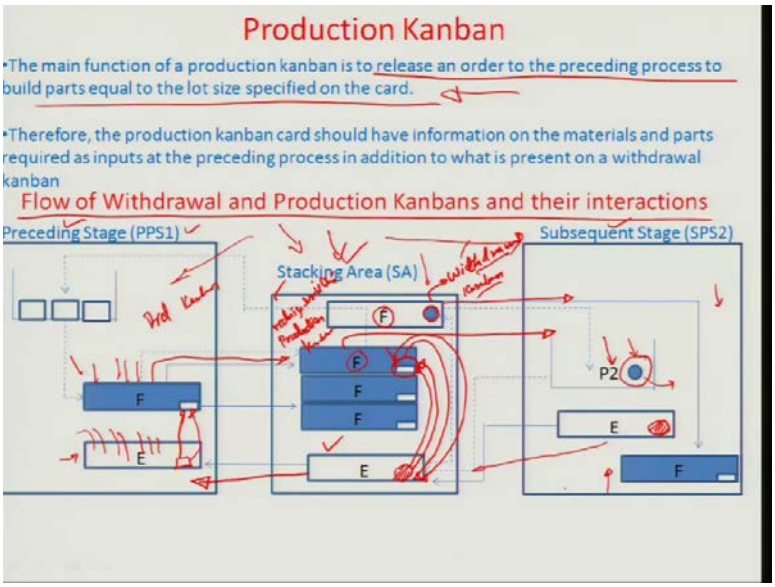

The production Kanban on the other hand is something which whose main function is to release and order to the preceding process to build parts equal to the lot size specified on the card. If I just want to see what is the flow of the withdrawal in the production Kanban and their interactions let us look at this particular case of two stations, one is the preceding stage PPS 1 and the subsequent stage SPS 2. So, these are two stations and there is a stocking area in between, where there is some little bit stock to absorb the you know the flow irregularities between the subsequent stage and the preceding stage which may happen between.

And so let us see that what part of the cycle does the withdrawal Kanban obey and what part of the cycle does the production Kanban obey. So, if I look at let say what is going to happen in the stacking area, let say there is a full container f which has some kind of a withdrawal Kanban card given by the circular figure here and place. So, the movement this withdrawal Kanban is putting this full container, the container moves ahead and the container goes all the way to the subsequent stage moment it comes to the subsequent

stage and the container is to be used now by the operator in the subsequent stage, he will pick this card the circular card and keep it in a stacking bin at p 2 location here.

So, the container is separate and the card has been kept at p 2 location and now the container is being used by the subsequent stage continually. So, know whenever the empty container comes out let say for example, there has been some, there was another container which was been partially use or it was just about to get finished when this ordering was them by the operator through the withdrawal Kanban means.

So, in that case the there may be some time delay and there may be some waiting period for this particular card and whenever that is a bin which is empty at this station this SPS 2 station, this bin can be put with this p 2 card and sent back as an empty containers. So, you can see that this p 2 withdrawal Kanban is going along, traveling along this empty container all the way to the site E.

So, you have now an empty container here in this stacking area. So, now, there is a roll of production Kanban will come into picture. So; obviously, there is a production Kanban card which is... So, this replaces the card here that you can see circular card which is the withdrawal Kanban goes and fits into a full container. And; obviously, the full container has this rectangular card that you can see this card actually is changed back to the empty container and this rectangular piece of card is called the production Kanban.

So, the circular is the withdrawal Kanban and the rectangular is the production Kanban. So, once I have said that this is the withdrawal in a production Kanban in place. So, your exchanging merely the full container gets the withdrawal Kanban. So, the circular moves up here and the rectangular Kanban comes done to the empty container and the empty container comes back or gets transported back from the staking area all the way to the preceding stage when this production Kanban which it had carried along is actually leads and there is a the movement it arrives there is a production plan which comes into this preceding stage, there is material processing which starts happening etcetera.

The people start initiating the empty container and make it full, but before that happens you ensure that there is some kind of a one bin or one lot in place which is already been produce. So, that the rectangular card now can be fitted to that particular full bin or full container from the preceding stage and the movement there is a rectangular card on it, the full container starts moving to the stocking area.

In the mean time, because you had this withdrawal Kanban circular card fitted on this full container, the full container would also starts moving towards a subsequent stage. So, therefore, the right side of the whole process from the stacking area to the subsequent stage as a cycling flow of the circular card that is the withdrawal Kanban and the left side of this process from the preceding stage to the stacking area as a circular flow of the rectangular card that is the production Kanban.

So, this is the production Kanban side and this is the withdrawal Kanban side and; obviously, the cycling flow has to be maintained in a well balance manner and that will determine the size of the stacking area or as a metro fact how much mini ((Refer Time: 15:23)) stock can be kept at the preceding at the subsequent stage. So, the overall you know behavior and this flow system is that the flow should be such that the container capacity that is the intention of the git system should be limited to one container, it is very difficult to achieve that kind of a capacity.

But obviously, the minimalist approach would be a better idea if you have instead of one about five containers to do all this stock balancing job between the PS, PPS 1 and SPS 2 you are very much there. So, that is the essence of the lean manufacturing and that is the way that is Kanban circulates and know I would like to increasingly valuate you know a ways and means based on a certain demand pattern or a forecasting pattern or whatever how you can maintain this over all flow balance with minimalistic inventory at a certain level.

So, we will try to estimate and do some problem examples how to actually calculate the number of Kanbans which would be flowing in a system to keep the system in active state. So, with this I will like to close on this particular module and in the next module we will probably do little bit of mathematical analysis as to how to estimate this over all Kanban level.

Thank you so much.