Management of Inventory Systems
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Lecture – 05
Introduction to Inventory and Materials Management (Contd.)

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So, during the session there is a fifth session of this week I will be referring to the two important so, the issues that is the concept of inventory flow cycle and the objectives and decisions of inventory control. Now, we have dealt with several important issues as an introductory reference to the subject called the management of inventory system and you know every when the any discussions on inventory control systems we always referred to a condition, what is a conditions linked with the flow of materials.

So, the inventory flow cycle in a given system or in a given say the manufacturing systems or the service systems; now this inventory flow cycle is to be presented first. And when you study this inventory flow cycle within a manufacturing system you can you know definitely you can we will come to know what are the positive features of the existing inventory control systems, what are the negative features of a the inventory control systems.

What are the priority areas in inventory management where you should focus on and what is the current level of performance mainly the operational performance, to what

extends the operational performance is related to the inventory control systems. So, all these the details you will come to know and when this flow cycle is presented if you feel like you know getting yourself involved and you try to improve the situation or improve the patterns of the inventory flow cycle.

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Now, here what is the basic issue involved over here? That means and inventory management systems in any organization involved controlling the flow rates of materials from upstream to downstream process. This we have been emphasizing this. Now, this is the concept now what you try to do; that means, of first exercise you carry out that is with respect to a manufacturing system which is under study. I need to present the manufacturing systems in terms of the flow of materials, different kinds of materials the flow rates will also vary.

So, in terms of the flow of materials within the system across different stages of the system, so obviously, you know this two important so, the aspect to be looked into. One is the flow rate and the second one is the level of inventory, that is very very important there are two aspects, one is the controlling aspects and if you look into the controlling aspects.

So, it will have a direct bearing on the level of inventory and if you lose control on the level of inventory ultimately what will happen that the flow also the flow rate other particular flow rate also you cannot maintain. So, always there should be a balance

because of the level of inventory what you have, now there is a limit to this level because there are may be other factors like the capacity which you can have which you have and the capacity actually determines the level of inventory and the so, this aspects to be to be consider and this is to be properly modeled.

So, this flow rate of materials inventory through the system depends on a number of factors. So, the first thing as have been have been the pointing out that first you get this flow it is to be drawn that the cycle must be known and then you need to determine the factors which actually determine the flow pattern of the materials within a manufacturing system. So, what are the main factors? The main factor is the level of supply and purchasing rate in respect of raw materials. So, ultimately what actually I am trying to represent; that means the relationship between the supply and demand, is it ok. So, there is there is a demand and the there is a supply.

Now, the supply you get from here from your manufacturing systems is it can you get the supply in instant of time? No. So, we have to get a supply and the rate of supply must be known the level of supply also must be note at a particular point in time and this is the rate and this is the level obviously, because of many reasons. So, there all the time that changing is the required rate and the required level, is it ok. So, the level of supply and purchasing rate in respect of raw materials with respect to one particular inventory item that should be known. So, this is the first factor.

Second one is the production control related raw material and WIP; that means, to what extends at any point in time so, the raw material is required, raw material is getting processed and when it is an incomplete states it remains in WIP. So, how long the raw material remains in WIP or incomplete state, if the time it is pains in WIP form is more obviously, you know it will have a bearing on the throughput time as well as the manufacturing cycle time.

So, the marketing rate in respect of finished goods and the level of demand so, the first one is the level of supply purchasing rate, the second one is the production control; what is so the production control you have that is and the control means your controlling the rate of production are the conversion rate from raw materials to WIP from WIP to a finished goods. Marketing rate in respect of finished goods on the level of demands so, these are the three kinds of factors. The flow rates across the system balanced supply

with demand. So, this is very very important and a typical inventory flow cycle for manufacturing system in shown in the figure.

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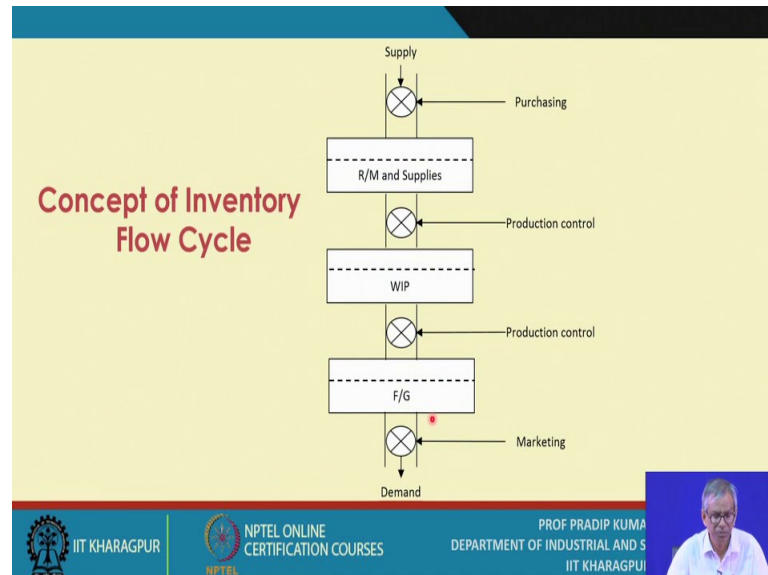
So, what is that? So, just you keep in mind and this is just a simple representation, what you have over here there is a supply and there is a demand, is it ok. So, which system actually or which function fulfills the demand? Obviously, it is the marketing one. Which the function of an organization deals with the supply; supply of what? The supply of materials and other purchase parts from the supplier.

So, obviously, there is a purchasing sale or the procurement function in any organization. So, now, given an item what could be the supply rate; that means, per unit of time how many how many units you require? Is it. So, that the production system is maintained and you maintain the this rate in such a way that it fits to this the output rate and output rate through the marketing sell, is it meeting the demand at any point in time or at least during the period of time, is it ok. So, every where you know this flow is determining this flow, this is flow this flow is determining the flow over here and this flow is determining the flow over here and ultimately whether this flow is at any instant of time or any point or in a period of time can meet the demand.

So, this is your objective. So, you can have a relationship between this and this, you can have a relationship between this and this entity right between this one you can have relationship between this and this and between this and this, right. So, the and ultimately

you check that at any point in time what is the relationship between the supply and the demand supply and the demand is any unbalanced, if it is an unbalance situation. So, what are the possible causes that is to be very clearly understood and this causes you need to know what are these causes and you have to take some preventive as well as the corrective measures at this point in time when the causes are occurring you have to take some corrective measures.

But, by taking the corrective measures he will know you will come to know the functioning of the internal flow cycle or the flow of materials the functioning that system in depth and possibly you can suggest some prevent some measures like say to what extend this purchasing departments needs improvement means performance. To what extent do you know, but the purchasing cycle or the purchasing procedure needs improvement, is it ok. There are certain policies existing policies related to that particular item, is it. Suppose, there is on yearly contract and you suppose this is an yearly contract item and that is why the flow is hampered suppose you can prove it with the data obviously, need to look into this aspects.

Now, at the time what you find the this raw materials in the supplies, at any point in suppose this is your level on an average at any point in time is it sufficient? or you do you need to reduce this level or do you need to you know say even if it increases is the highly in effect? Is it ok. So, at any point in time these raw materials in supplies, obviously, as far as objective or inventory control system is concerned your main objective is to how to reduce the level of raw materials and supplies at any point in time.

Similarly, the production control now I have just shown to production controls, but actually as you know that the production the entire production systems it may have so n number of production stages. So, n could be you know the value of n could be 10, 20 like this. So, from one state to another so, there is a control mechanism, ok. So, that is basically the production control we that is a general the term I have used, but otherwise you know that could be the different processes you have, there could be different processes here not only this one stage there could be multiple stages, is it ok. This is just a conceptual you know the framework right and the where we want to highlight the important the points, ok.

So, again obviously, your exercise could be the WIP overall WIP I must have a mechanism with which I can measure at any point in time at least I will be able to estimate the WIP over all plus I must have a mechanism to measure WIP at each work centre or the production stages, is it ok. Now, whether this amount of WIP is acceptable to you or not; if it is not acceptable in majority of the cases you needs improvement.

So, you need to reduce the WIP. So, if you can if you if you reduce the WIP there are many advantages, but in that case it is to be tuned you know the increment in the production rate or the input rates, the output rate. So, somewhere you make a change in some other aspects some parameters to what extend to the parameter values are affected you should be clearly understood and these are the critical issues related to the inventory management systems.

So, just I want to just highlight with the main point that is you know unless and until your inventory control systems become an online and real time control system. In many cases the mathematical modeling in may be may be in 20 percent of the cases, 25 percent of the cases the kinds of systems of the kinds of systems you come across the kinds of condition we come across.

Mathematical modeling be difficult and even if you have a mathematical model the real issues you may not be able to highlight in the mathematical model the assumptions which you make for making a mathematical model may not be valid in a particular instant of time at a particular point in a given situation. So, in many cases you try to adopt an online real time control systems. So, here the modeling is made in such a way that it helps in establishing a online real time inventory control system, ok. So, these are the rare. So, this is the finished goods level and this is your demand revit, ok.

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So, this is the issue now there is a concept of. So, the inventory flow cycle how do you represent mathematically this point I was elaborating how would you represent mathematically the relationship between supply and demand considering the flow rates of different types of inventory with relevant control parameters. So, this is the question and posing to you just make a note and later on when you will be carrying out several exercises, numerical problems, the case studies and all I am sure that I will be able to you know propose a relationships are developed the relationship between supply and demand, is it and in terms of the flow rates of different types of inventory, is it ok.

Raw materials RMO's then you have another WIP the finished goods and all those there could be different the types of control. So, that you have to identify. So, this is an important issue you need to consider.

Now, what I am telling you that there is one particular topic we will be discussing maybe in the and the later the week maybe in the other tenth or tenth week will be discussing a topic or theory of constants. So, at this point in time you know related to the inventory flow cycle I need to bring in or I need to discuss the concept of theory of constraints this is also known as you know different names are given. Anyway, let us let us think about this theory of constants and to what extent this theory you can apply for a streamlining, the existing inventory control systems.

So, so, what I am telling you that when you refer to the inventory flow cycle the concept of inventory flow cycle, the application of theory of constraints is relevant, right. In theory of constraints later on will discuss in detail just some important are the points I like to highlight at the stage in theory of constraints we need to balance the flow rate of materials in different forms among different stages or the resources of a manufacturing systems, is it ok; that means, at different stages or the resources of a manufacturing systems is it; that means, at different stages or the resources their inter connected.

So, you try to maintain the flow of material in such a way that the overall flow; that means, as well as the system you know the flow was a system is mentioned; that means, at one at one level you was getting the supply and at the same instant of time you are getting you know the output from the system and it goes to say the market; that means, demand is fulfilled. So, there is you know almost one to one relationship ok. So, the

constant flow that is the perfect condition is the balance is maintained. So, if you apply theory of constraints. So, it will help you in balancing the flow of materials.

While you try to maintain a balanced workflow of materials in the system determining the system performance we need to look into the relationship between capacity and demand with respect to a particular resource. Now, what you can say that this manufacturing system consists of a number of production stages. Now, each production centers stages of the work centre or the profit centre as you defined, right. So, it has is boundary line and what you have it has it is considered to be a resource.

So, any resource you identify say capital equipment, what will have. So, you will have it will have it is. So, it will have its capacity as well as it will have as it is demand in post on it at any point in time the machine is standing in front of you that is your resource I know what is this capacity with respect to a particular with respect to a particular item are the components or say raw material and as well as with respect to particular process settings is it once it is not the capacity is estimated.

Now, you wait for the materials to be processed at that particular equipment; so, that means, now the capacity is known whether you get the demand as per the capacity or not. So, if at any point in time or during the time period if you find that the capacity is more than the demand imposed on the particular resource then you say at that capacity at that resource is basically a non-bottleneck, the capacity is more, excess capacity you have; whereas, at the same instant of time you will find that for another resource is it ok, another resource the capacity is less than the demand is obviously, that resource is termed as the bottleneck resource.

So, in order to the maintained the uniform the flow of materials within a production systems, within the manufacturing systems the first thing you need to know that whether it is effected by that means, entire performances system performance, the manufacturing system performance is affected by the performance of the bottleneck resource or performance of the non bottleneck resources.

So, in all the time because of you know you know that if for the bottleneck resource performed excellently you will find the there is a corresponding effect positive effect on the performance of the system. Whereas, if the non-bottleneck resource you improve the performance of the non-bottleneck resource it is it is improvement in the performance in

the non-bottleneck resource may not necessarily improve the system performance at the manufacturing systems level. So, these resources are classified under two categories as I have been telling you one is the bottleneck capacity is less than the demand, is it and the non-bottleneck means the capacity is greater than the demand.

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While we study the inventory flow system as it is depicted by that the flow diagram we need to increase the flow rate of inventory from a bottleneck resource the, that is the point to be noted. Inventory control systems are developed and updated in such a way the there is always a scope of improvement in the utilization of the bottleneck resources ok. So, that should be your focus; that means, you may come across some the fifty such resources, in your manufacturing systems everywhere there is an inventory control system.

Now, what do you what do be your priority areas or priority resources where you know inventory control system should be the studied first or the assist first. Obviously, among all the resources that you are dealing with you first select or you first identify what are though bottleneck resources. So, if you improve the performance of the bottleneck resources; that means, is capacity to be enhanced and the capacity you can enhance only when is it only when; that means, and capacity enhanced, so that the you know it can accommodate increased the demand, is it.

And, there are many ways you can do that later on will study it what will find that ultimately the inventory flow inventory flow will improve and if the inventory flow improves with respect to the demand on net from the bottleneck it will have a direct bearing on the you know the inventory control systems so, the overall materials management systems of the manufacturing system as a whole.

So, under the theory of constraints the meaning of the term inventory that is to be noted. Now, here under theory of constraints we used the term call inventory or it is meaning is different the inventory, is amount of money invested in plant equipment and materials for producing the throughput. Now, what is the throughput? The amount of actual sales made that means, you are producing something. Suppose, I produce save 1000 units; now, out of one thousand units I could sale only the 500 units; that means, this is the money which you get by selling 500 units that money is referred to as the throughput whereas, the remaining 500 unit produce, but that is you produce to stock. So, you not getting any you inflow of money. So, that is not considered to be the throughput.

Now, in order to improve the throughput what you need the necessary condition is that you must you must be able to improve the inventory level. So, what is this inventory? Inventory means the amount of money you invested is it ok, to get the throughput right and obviously, there will be some expenses you incur and that is referred as operating expenses.

So, under theory of constraints of the three terms we used; one is you know the throughput; that means, the amount of the money you make and then you have the inventory; that means, amount of money reimbursed and then you have the operating expenses; that means, amount of money you spend to convert inventory into or investment in to selves, is it ok. So, the focus is on inventory, but here you know what is important is that the inventory what you are saying that the inventory is idle resource ah, but idle resource with some economic value.

Now, you maintain the inventory flow of inventory in such a way that quickly you are able to convert the inventory into the finished goods as quickly as possible and it is most likely that if the inventory transforms itself to the finished goods form; that means, very soon it is expected that you can convert the finished goods into the sales proceeds. So, as quickly as possible you have the raw materials, you have the WIP inventories in your

manufacturing systems. So, it is most important that how quickly you convert these raw materials; you convert this WIP into the finished goods stage that is the necessary condition.

What is the sufficient condition or improvement of the inventory control system the sufficient condition is that how quickly you can you can sale; that means, the finished goods inventory there is a capital tired up with the money tired up when you can sell the finished goods inventory; obviously, that money is released from the inventory. So, any you know the inventory control exercises which you carry out whether it is for the finish goods or the raw materials or for the WIP the main purpose you must not forget. The main purpose is how quickly without disturbing the flow of materials within the system how quickly you can release the capital from this idle resources.
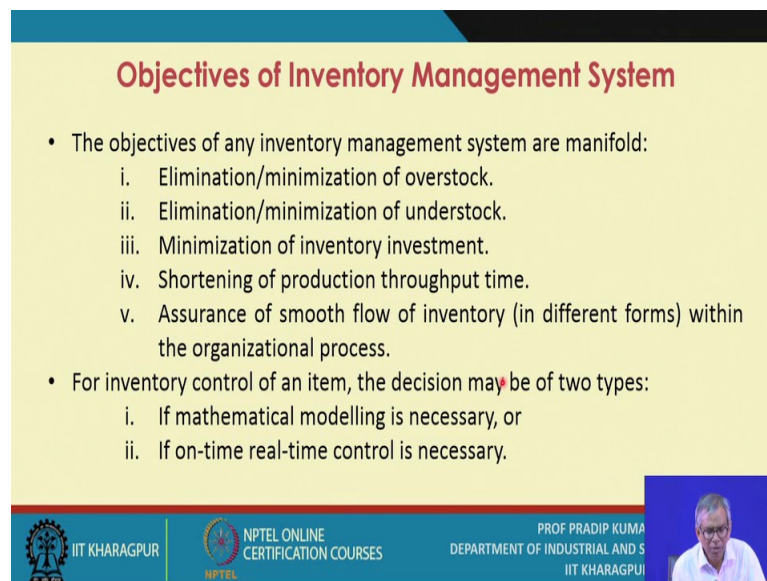
And, for many time what happens that if you cannot maintain the quality of inventory it may so happen that you are keeping the inventory in your in your stores, but you are not using it. So, many a time the main problem you know this the managers they face given at the corporate level the how to dispose it off the non-moving items or even the even the slow moving items.

So, there are three as far as flow is concerned there are three kinds of the inventories three types of inventories you come across; one is the fast moving, second one is a slow moving and the third one is the non moving. So, the non moving there could be many reasons, later on when we go for selective inventory management we will discuss this part, but right at this point I like to highlight one very important point that is you know the non moving, the inventory or the non moving item may become a debt stock. And the debt stock is a serious problem in many materials management functions you will we may face a situation where you know 80 to 90 percent of the time as a top executive of that particular function you spend on ways and means on how to devise whether means to dispose of this is how to write them of; that means, the debt stock item.

So, ultimately if the inventory control problem is not adequately looked into later on maybe after 5 years, maybe after 2 years it all depends on what is your inventory level for how many different types of inventory items we are dealing with. You will come to a situation where you know you will be dealing with excess inventory. So, excess stock, it is not the safety stock. It is excess stock and you have to think of ways and means to deal

with the excess stock the in this particular the course I will be discussing this aspect also, but first I will be discussing different types of inventory control models, different kinds of inventory control models and later on this important issue; that means, how do you determine the excess stock, its implications, what you what do you do with the excess stocks, what are the alternatives you have for the liquidation of this excess stock this is part also we will discuss.

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So, more or less as the introductory lecture we have identified several kinds of objectives, we have identified eliminate of inventory control systems like elimination of over stock or minimization of overstock or elimination of minimization of under stock, minimization of inventory investment these are the objectives you should we should remember this part. Shortening of production throughput time, assurance of smooth flow of materials this point is very very important in different forms, inventory in different forms within the organization process.

So, for inventory control of an item the decision maybe of two type; So, please keep in mind these two aspects if mathematical modeling is necessary first given a problem or you will get a problem details related to inventory and you conclude the mathematical modeling is not the priority. Priority is develop an online real time control system.

Thank you.