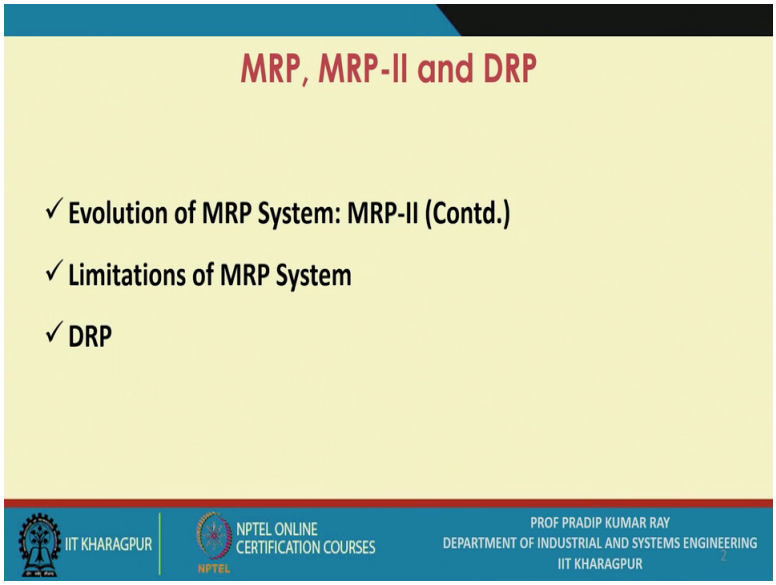
Management of Inventory Systems
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering
Indian Institute of Technology, Kharagpur

Lecture – 35
MRP, MRP-II and DRP (Contd.)

This is the last session on MRP, MRP-II and DRP. Now, during this session lecture sessions I will be referring to mainly the MRP-II systems and it is a the latest for the systems in use and so, we have refer to evolution of MRP systems.

(Refer Slide Time: 00:35)



In the last lecture sessions I have refer to the closed loop MRP systems and what is required that why do not you extend this closed loop MRP system to the manufacturing resource the planning. In the sense that not only say the materials or so, the inventories of say the materials or the or what you can say the items or the components say you require. There may be other kinds of resources you need to use and why do not you link your MRP systems or closed loop MRP systems to other kinds of resources so, that you take a total view of your manufacturing systems.

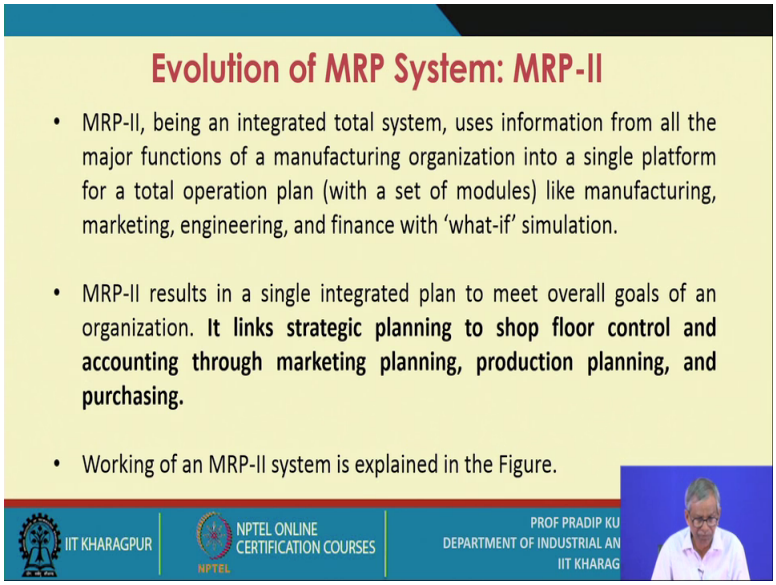
And so, when you extend you know materials or the requirements planning to manufacturing resource planning; that means, that is also MRP, but that is the next version that is that is why it is referred to as the MRP-II. So, the so, we will discuss in

detail the MRP-II and why it is required, what are the critical or so, what are the main characteristics of MRP-II.

And we will also highlight some of the some of the limitations or the limitation or of so, the MRP systems original limitations you will you will it should be aware of the limitations systems because, the no system is a has a 100 percent pull system. So, there is always a need for improving that is why the evolution of MRP systems you also must know.

So, the limitations of MRP systems and then we will refer to the distribution requirement planning. So, or the DRP many many organization this days they try to include the try to include the distribution network of their products in to the into the MRP frame work. So, so, how do you how do you do it, why do you do it, why the DRP has assumed importance. So, all these details we are going to discuss in this lecture session.

(Refer Slide Time: 03:23)



Now, againthe referring to evolution of MRP systems what we find that these days mainly we are using the MRP-II systems, many progressive organizations particularly in the manufacturing category and manufacturing industries they have adopted they have been using the ERP systems. And the ERP system is essentially or the basic logic of ERP system the rests on the MRP-II.

So, whenever someone becoming conversant with MRP system he or she must be conversant with MRP-II systems. So, the MRP-II being an integrated total system whereas, MRP is not necessarily an integrated total system. It is essentially linking inventory control system with the production control. But, there are many other subsystems you come across you have to consider while billing the total system for an organization.

So, the MRP-II uses information from all the major functions of the manufacturing organization into a single platform for a total operation plan with a set of modules. Now, here when you say that all the major functions. So, you must be aware of what are the are the major functions you may have. So, I will just mention what are the important the functions as per say ISO 9001 standards or the equivalent American Standard Q 90 91 standards 92 94 standards.

So, these functions are some of the important functions are marketing and market research, then the specifications engineering or the product the development. The third-one is the procurement ok. The fourth-one is the process planning and control. The fifth-one is the production ok. So, these are the functions need to refer to.

The next one is you know that inspection the test an examination that is the final inspection test and examination. Everywhere you will find when the product is ready so, you go for its final inspection. Then the next one is you know the packing and storing, the packaging and storing. So, this is also a very very important functions..

The next one is actually the sales and distributions and then you can have suppose it is an industrial product, what you try to do that we need to install it, install the product. Suppose the transformer is your product and the transformer needs to be installed at the customers the worksite ok, the customers production system.

So, installation and operation is a very very important function particularly for the industrial products. And the next one is essentially the maintenance on the services ; that means, you must be you know aware of what kind of problems it might face within the warranty period and all. And the last one that is the disposal after use; that means, the product is born and the product also dies. So, the disposal is in a very important activity. So, these are the main functions you have.

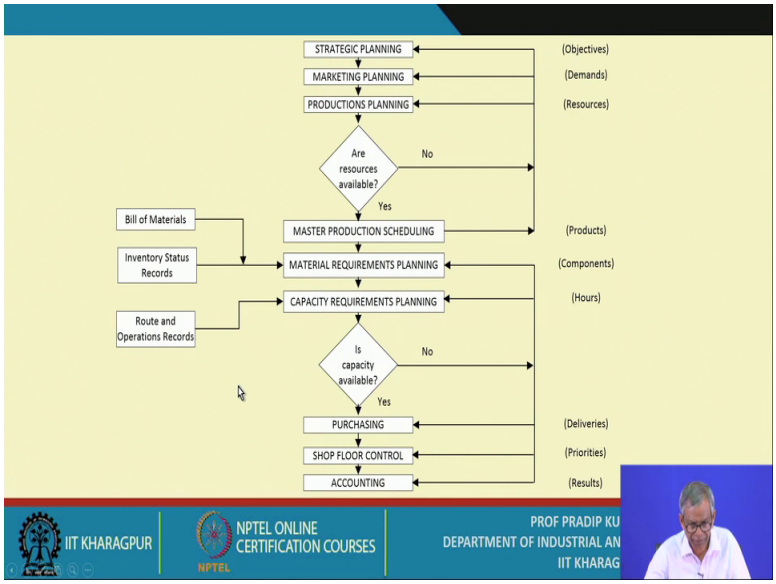
Now, the question is that why do not you have a total system involving all these the important to important functions and you try to and everywhere there are resources. So, why do not you can have say the manufacturing resources or say a manufacturing resource planning or the MRP systems considering all the important functions of an organizations.

So, this is a very challenging task. So, but in many cases what you try to do ; that means, you try to include in MRP-II systems some of the the functions like manufacturing obvious, then the marketing, then the engineering functions what we have mentioned as the specifications engineering or the product development. And you also include the finance with what if simulation and sensitivity analysis.

So, what if simulation is an important module in many such MRP systems, manufacturing will be there, marketing will be there, engineering will be there and the finance is is an important the module and with a common module of say what if simulation.

MRP-II results in a single integrated plan to meet overall goals of an organization. So, you are proposing a total systems of control. It links strategic planning; that means, at the at the corporate level to shop floor control and accounting through marketing planning, production planning, and purchasing. So, you just look at this figure.

(Refer Slide Time: 09:16)



So, I have try to explain all the important you know the functions or important modules in the MRP-II systems. So, what you have; that means, you have the strategic planning that is one objectives or the goals of strategic planning; objectives you must know.

Then you have the marketing planning that means, the demands of the products, then you have the production planning. Now, whenever you refer to the production planning you come across or you need to use several kinds of resources. You have to mobilize the resources for which the planning is is a must.

Now, the first question you raise that is, are resources available? So, availability is a very very important factors the key consideration. So, if it is no; that means, again you go back to the production planning, is it one important function called process planning and control. So, they look into these aspects.

Next if the resources are adequately available then you go for go for master production scheduling is it ok; that means, now you are able to make the schedule product wise is it the schedule. And for that you need the documents called the bill of materials, inventory status records, and then you have the material requirements planning. Already you know that these are the three documents you require MPS, bill of materials or the product structure records and this is the inventory status records.

So, you have the material requirements planning that is the first version, then you link it with the capacity requirements planning. I have already mentioned when the when I discussed that and a closed loop MRP. So, the open loop MRP as has become a closed loop MRP and here these particular records you refer to that is routing and operations records.

Now, this routing actually it is an important concept and ah; obviously, there will be a process planning sale. That means, you have the design details in the form of say with the drawings and the bill of materials. And, but you also must have the process plan and whenever you create a process plan there is this is a structured approach in fact.

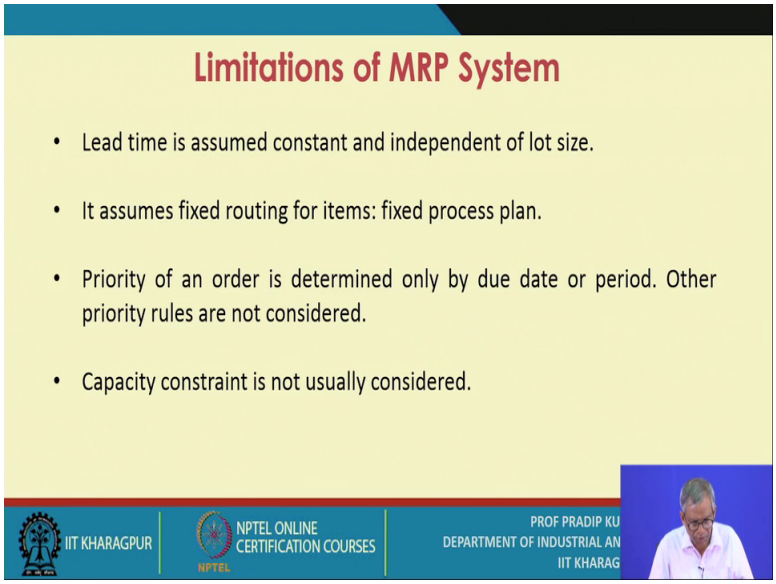
So, the given a particular part or given a particular component or subassemblies now, you will come to know what are the sequence of operations to be carried out with the resources. Like the machine tools or the cutting tools, then the work holding devices the many at the details are there in the process planning documents.

And so, when you when you look at the sequence of activities to be carried out, sequence operations to be carried out you have the information's on the routing. So, is capacity available? If it is no, then again you go back to the capacity requirements planning phase and you try to the create these capacities. And if the capacity is available you go for purchasing, you go to the shop floor control.

So, ultimately the shop floor control is very very important in fact, and accounts departments is also getting involved; that means, the finance part also you should take into account. So, this relates to the objectives, this is the demands. Production planning is related to the resources, master production scheduling is related to the products, material requirements planning is related to the components particularly the dependent demand items or the components.

Capacity requirements planning in terms of the time units that is the hours availability, purchasing deliveries ok. And a shop floor control; that means, the [prior/priorities] priorities. That means, what sort of the scheduling techniques you must have, what is the sequencing and all those loading and sequencing. And the accounting that means, ultimately the results ok. So, this is essentially an MRP-II systems.

(Refer Slide Time: 13:59)



Now so, the MRP-II systems you study and you will notice that it is a total system, not only one kinds of resources almost all kinds of resources are the levels are to be

controlled online and the real time basis. And so, that so, that the decisions you take will have a direct impact and you have an opportunity to collect your decisions all the time.

So, butyou know the when you create an MRP system it, but there are certain assumptions you make. And because of a due to these assumptions there may be some inherent the limitations in the MRP approach. So, I would now like to highlight the specific limitations of the MRP systems ok. Whether, it is a MRP-II or say or the closed loop MRP what is whatever it is.

Now, here the first limitation is the lead time is assumed constant this point already I have mentioned, and independent of the lot size. This may not be the case in many many many a time so, you are assuming lead time is assumed constant. The second one is second assumptions we are making, second limitation is it assumes fixed routing for items, fixed process plan.

But as you know the many a time the flexibility is inbuilt in the process planning systems. That means, suppose a particular the operation you your is not be getting at a particular say the point in time because of many reasons. So, and the that machine or that particular machine tool is not made available, it is it may be under breakdown conditions.

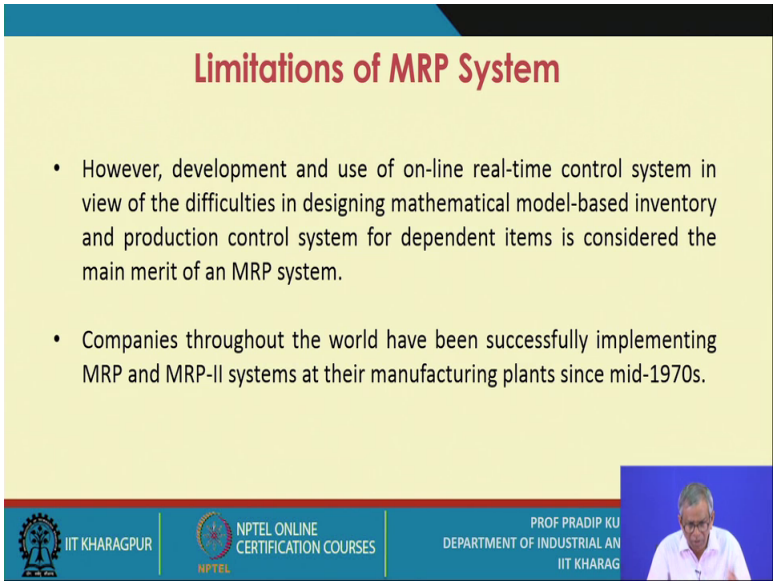
So so, the flexibility is a must be the inbuilt in the process planning. So, what you try to do again you think of the alternated alternate process plans ok. So, this version this the option is there, this flexibility has to be there in the process planning systems. So, but here for the MRP systems we assume that the roots cannot change. So, it is a fixed say the process planning.

But you can make it flexible and I and there are many many versions of MRP, where this part as that means, the flexibility has become an important say the characteristic of the MRP system. Priority of an order is determined only by due date or the period. So, when we refer to you know the job shop signaling you know there may be many kinds of priority rules. Like say the earliest due dates, like say the shortest processing time or some you know so, there are many others in fact so, the priority rules.

So, here only one priority rule you opt for that is the due date or the period is it ok. Other priority rules are not considered is it ok. And the capacity constraint is not usually

considered is it ok, in a MRP system whereas; in MRP-II system this capacity constraint is considered. Or even in closed loop MRP system closed loop MRP systems so, the MRP system originally MRP system is linked with the capacity planning system. So, the obviously, the capacity constraint is considered in MRP-II systems but, not in the original MRP systems.

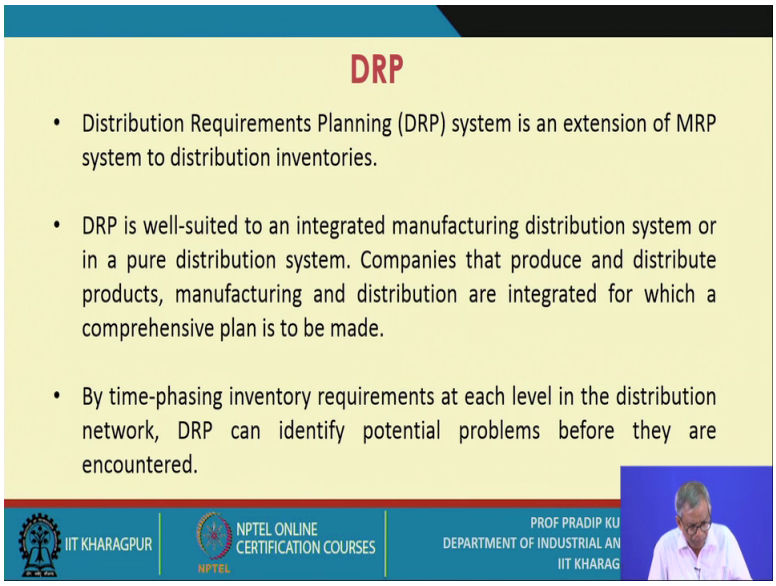
(Refer Slide Time: 18:15)



However, development and use of on-line real-time control system in view of the difficulties in designing mathematical model-based inventory and production control system for dependent items is considered the main merit of an MRP systems. So, this point you please make a note; that means, for the dependent the demand the items in large numbers normally they exist in large numbers.

So, the mathematical model-based inventory and production control system cannot be developed. So, that is why you go for say MRP systems. Companies throughout the world have been successfully implementing MRP and MRP-II systems at their manufacturing plants since, early or the mid-70s

(Refer Slide Time: 19:22)



Now, before I close the session I will just I will be the discussing certain important aspects of the DRP or Distribution Requirement Planning. Now, what is a distribution requirement planning system? Now, a distribution requirements planning system is an extension of MRP system to distribution inventories is it ok. Like say what you have actually, you have the factory systems or the manufacturing systems. And from the manufacturing systems you have the outbound logistics systems and these logic through these outbound logistics systems your product goes to the to the user is it ok.

So, so in between you can have say the storing the finished goods storing's. So, in between you can have say the whole selling wholesalers, it goes to the wholesalers and then it goes to the retailers. And then the items are the procured or items are purchased from the retailers, suppose you say consumer items. So, for the industrial products there could be a different types of say the outbound logistics system.

So, basically it is a distribution network and obviously, the so, there could be different control points in the distribution network. And I have to make a you have to make a plan so, that in advance so, that whenever at say the user or so, the customer or the needs and item the required quantities these the quantities are or this item with the required quantities are made available ok.

So, without say the waiting time , in order to say so, the maintained so, the timely and the delivery of items to the users. So, you need to so, the consider so, the resource

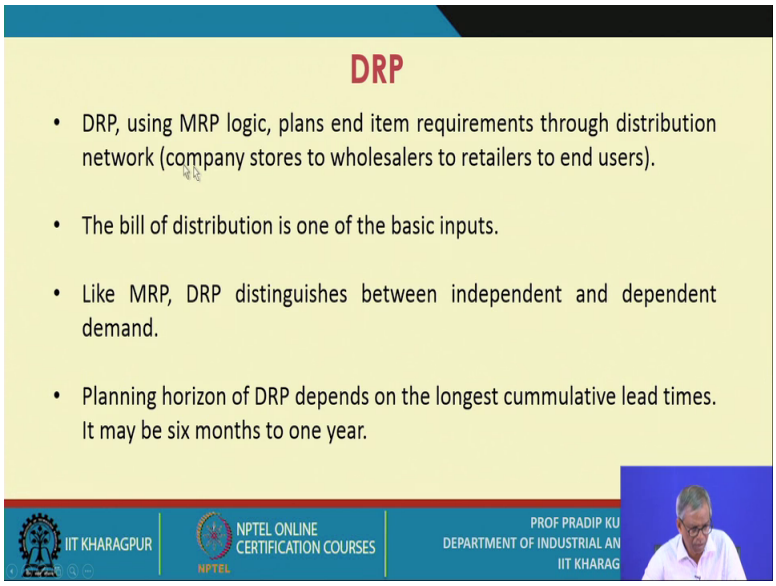
planning systems within the distribution network. So, essentially in a DRP system the focus is on the flow of materials or the flow of finished products within the distribution channels and within say the distribution network.

And this the flow of the finished product should be as smooth as possible ok. So that means, the timing will be maintained and or the required quantities are to be made available. So, this is this is a say an important aspect. And that is why you know the today when you talk about the total systems the manufacturing system is when you try to explain the manufacturing system. So, the manufacturing system we explain in terms of say the constraints imposed by so, the distribution systems or you know to what extend the manufacturing system is characterized by the characteristic of say the distributions network or the distribution systems.

So, the DRP is well suited to an integrated manufacturing distribution system ok. So, in majority of the cases we talked about these days the integrated manufacturing distribution systems or in a pure distribution systems. So, either the DRP systems you use sorry you implement for the integrated manufacturing distribution systems or for certain products ok; you must have you need to consider the distribution system separately. So, why do not you have a DRP system exclusively for the distribution networks.

Companies that produce and distribute products, manufacturing and distributions are integrated for which a comprehensive plan for which a comprehensive plan is to be made. So, this is your the main objective. By time-phasing inventory requirements at each level in the distribution network, like you do for the manufacturing system, same approach you follow and, but this approach is to be implemented for the distribution network. So, the DRP can identify potential problems before they are encountered.

(Refer Slide Time: 24:33)

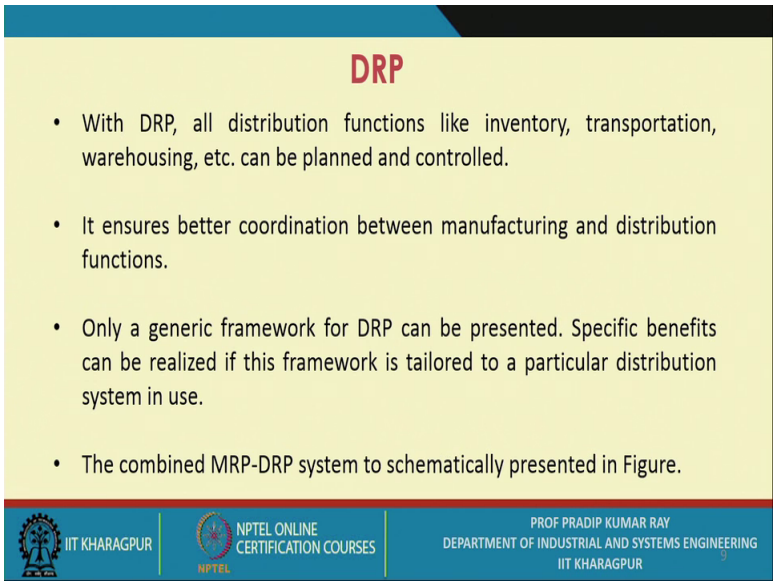


DRP, using MRP logic, plans end item requirements through distribution network companies stores to wholesalers to retailers to end users. These are the are the four principle say the control points you have. The first one it it the end items are in company stores then it goes to the wholesalers, from wholesalers to retailers and the retailers to the end users is it ok.

So, the bill of distribution is one of the basic inputs. Here like say for the MRP so, the bill of material is the basic input, but here for the DRP the bill of distribution is one of the basic inputs. So, same for the logic you follow, you have the inputs, you have the outputs for the DRP. Like MRP, DRP distinguishes between independent and dependent demand, is it same logic.

Planning horizon of DRP depends on the longest cumulative lead times. It may be six months to one year. Now, here this is an important issue to be considered in MRP or the MRP-II what you find that for that it is the short term planning. So, a week wise or maximum you know say or the fortnightly you make a plan. But so, the every week you control whereas, here are the distribution network; that means, there is a transport facilities and all. And normally the planning horizon is six months to one year that means; with a longer time frame you develop the DRP, DRP systems ok.

(Refer Slide Time: 26:29)



With DRP, all distribution functions like inventory, transportation, warehousing; warehousing actually the indicative of storing etcetera, can be planned and controlled. So, like these days we talk about the supply chain management. So, one of the important issue of the supply chain management is distribution requirement planning.

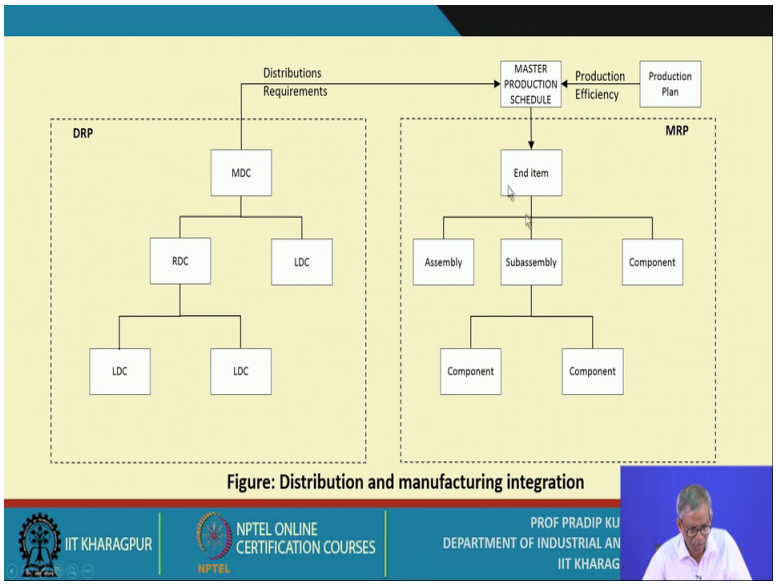
Later on we will discuss the supply chain management issues. So, you can link it that means, from the factory we move to say the distribution the network. And ultimately we these two the systems as a part of say the bigger the supply chain network ok.

So, the both inbound logistics as well as the outbound logistics you need to consider. It ensures better coordination between manufacturing and distribution function that is obvious. Only a generic framework for DRP can be presented. Specific benefits can be realized if this framework is tailored to a particular distribution system in use. Now, this is an important point. Like say you know the DRP the system or say basic the distribution network varies from say the one company to another; from say the for one product mix to another product mix.

And each the distribution network is a is a unique one. So, what is what is you know the desired or what is expected is, that a general framework of DRP you can propose that can be made, I will show you that what is the general the framework. But ultimately you know what you need to do that means, a particular case you have to take; that means, one case example you take up as an assignment.

And you develop on the DRP or the distribution or the requirements planning systems for that particular say the network. So, this framework is tailored must be tailored to a particular distribution system in use. The combined MRP-DRP system is schematically presented in figure.

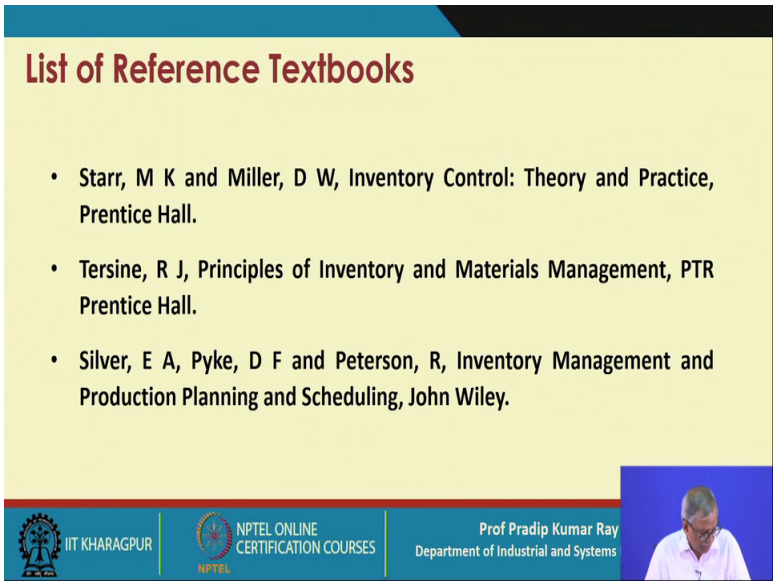
(Refer Slide Time: 29:06)



So, here what you have you have the master production schedule. So, you have a production plan. So, the production efficiency an important consideration, this is the distribution requirements after you get the product. So, you have this is the DRP systems, is it ok. This is the local, regional and this is at the masters levels ok, distribution channel is it. So, the main distribution channel consists of regional distribution channel, the local distribution channel, this is the local distortion channel it is LDC.

And similarly, for the master production schedules that is the end items assembly subassembly components, this part is so, this is basically this is bill of material. And this is basically the bill of the distribution; this is the bill of distribution. So, this is the MRP systems and this is the DRP systems. So, what do you need to do that means, the distribution requirement planning's must be say explained or must be presented or must be implemented along with the MRP systems. So, that is why it is referred to as a combined MRP-DRP system ok.

(Refer Slide Time: 30:37)



So, what the companies they have observed that if you say, if you opt for a combined systems DRP-MRP systems so, your performance will be excellent. And there will be lot of advantages in the in the context of inventory management, particularly what you will find that that the order size or say you know the overstock amount or the under stock amount at a particular the point in time we will have enough control on these three aspects.

And particularly, one important aspect is one important problem the inventory management system finds very very critical; that is dealing with non-moving items or dealing with excess inventories. So, what they have observed, if you have an MRP the DRP combined system so, at any point in time you will have the minimum amount of minimum amount of say non-moving items and excess inventory. So, it will have an a significant impact on the company's financial performance so.

Thank you.