Decision Support System for Managers
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Module - 04
Lecture – 24
Automated Storage & Replenishment Systems (AS/RS)

Hello and welcome to "Decision Support Systems for Managers"! We are into module-4, 'decision support systems for material managers'. And today we are in lecture-9 of module-4 that is 'automated storage and replenishment system' which is also called as the 'AS and RS system'; ok.

Now as you know that our objective in this module right from the beginning we have mentioned that the purpose of a materials manager today is manifold. He or she has to take decisions on where to locate the warehouse, how much should be the size of the warehouse, and then how should you have a layout design of the warehouse; ok.

Now, in this connection we learnt one very-very important thing and that is, we must try to synchronize the demand with the supply. If we can do that, then the space required for warehouse will be very-very less. Because if you can synchronize the demand with the supply, then there will be no leftover stock at the end of the day, and so here we will have zero inventory and so less requirement of warehouse space; ok.

So, this is basically the idea and what all warehouse managers are striving to achieve, and that is why you will see that there is a renewed focus on forecasting techniques that companies are now undertaking. And forecasting techniques you will learn in a subsequent module. So, if your forecasting is more or less correct, then you can synchronize your production as per the forecasted demand. And so then it will be very very helpful because you can reduce the cost.

See, let us take let us digress a bit and taken let us look at forecasting for some time. You see forecasting maybe it is a digression from this module, but you will understand the importance of forecasting. See if you can forecast exactly how much your demand is, then what is happening?

You can buy the proper amount of raw material, you can do a production planning means you can find out how many shifts – production shifts you need to run, whether one shift per day or two shifts per day or three shifts per day you can sync you can estimate how many production shifts you need to run per day. Because if your demand is more, more production shifts; if your demand is less lesser production shifts, so that your work shifts normally we call it as work shifts. So, that kind of planning you can do.

You can plan for raw materials. And if you can plan for raw materials, you are in a better position to negotiate with the suppliers ok. Third thing that you can do if you can do a proper forecasting, you can do your transportation planning. Transportation planning looks very easy, but it is the most difficult task.

See vehicles are made by somebody else, vehicles have a capacity, and your production will not match that capacity. So, you will have to again see whether your vehicle has a full load; if not what is the load, whether you should take a small vehicle, whether you should take a big vehicle.

Suppose, your order quantities only this much, but if the order has to travel 1,000 kilometers may not be possible for a small vehicle to transport. You have to take a big vehicle.

The big vehicle huge capacity, and you was only sending this much, so not feasible. So, then you will have to look for a third party transporter who will charge a bit more, but he will carry your break bulk cargo. So, all these planning has to be done. So, if your forecasting is correct, this planning can be done very-very effectively.

Now, suppose you are a company which produces a product that is required all throughout the year, even demand. So, what is happening? If you know that even demand, then you can negotiate with the transporter on a long term basis that I need 5 vehicles every day, I need 20 vehicles every day ok. So, negotiation can be done on a regular basis.

So, all these are so the warehouse manager's role today is very, very essential. Now, how is forecasting related to warehouse manager? Demand is x. Warehouse manager will tell know last year also you said demand is x, but last year data shows that this much

quantity of material was lying in the warehouse unsold or unsent. So, maybe there is something wrong with your forecast or some error with your forecast.

So, please visit and redo your forecast that is what the materials manager will tell to the forecasting team or the strategy team that we have this much of stock. And nowadays what is happening? The warehouse the materials manager, they are also being asked. You do your forecast based on your stock position that you are witnessing day in and day out over the last 8-10 years.

I will tell you about an incident about a case there was this company who had manufacturing units in force and four places in India of which the most important one and the largest one was in Maharashtra. Now, this company suddenly felt that if we give free distribution means we will pay from our pocket to the dealers and the wholesalers, then our sale will increase ok; then our sale will increase.

If we will give free distribution to our wholesalers, then our sales will increase within Mumbai city. And they said the since my anyway my demand is fixed x or y quantity, if I give free distribution that that I will get more captive dealers, and they will buy from us because other companies are charging for delivery.

But you know after 1 year, the warehouse people started complaining. Complaining in the sense that they found it out that the total number of vehicles that are coming in and going out of the warehouse that has increased. What does that mean? Total number of vehicles coming in and going out that has increased only that much information was received from the warehouse.

That brings us to two points – total number of vehicles doing to and fro that has increased means my order has increased, my demand has increased that is one interpretation, my demand has increased, that is what the company wanted free delivery, so demand will increase.

But there is a second interpretation to it also that is earlier me as a distributor was ordering 100 boxes altogether, but now because it is free delivery I do not want to stock 100 boxes in my shop, I will stock only 4 or 5 cartons.

And whenever I required whenever the actual and those 4 or 5 cartons will be safety stock, they will be in the display, or whenever an order is actually generated what will I do? Anyway the order delivery takes 1 or 2 hours, I will straightaway tell the company that you please deliver this material directly to the customer's premises.

So, it is not a single free delivery from the company to the warehouse to the wholesaler go down. From the company to the wholesaler go down that was the intention free delivery. But now the wholesalers was saying, no, do not give it to us; from company to the customer, give a free delivery.

So, you were trying to give a portion of it as a free delivery, but now they are saying no entire thing is free delivery, and that was happening whenever order was being generated, 1 box, 2 boxes, 3 boxes only, but earlier system I had to order 100 boxes, now 3 boxes.

So, what was happening? Transportation cost was increasing. Now, this data will not be captured at the strategy level at the head office level. This data will be captured at the warehouse level. So, the materials manager today has to perform not only materials management activity, a multifaceted multivariate activities the material manager has to perform. This is what I wanted to sensitize you; ok; ok.

Now, that we were discussing storage systems and storage patterns. We calculated how much warehouse space you require, we calculated as to what should be the stacking height, we gave you examples of equipments used in the warehouse, we gave you examples of how materials will be stored in the warehouse, we gave you caged warehouse, some markings are there, codes are to be kept there, so safety, etc.

Today we will discuss another topic which is called as AS RS system. What does that mean? Automated Storage and Replenishment System. Now, that very name signifies everything, automated storage automated replenishment, that means, I have this much of quantity of goods with me, and wholesaler in my warehouse, wholesalers and distributors are taking it away based on orders, so material is going out.

So, when whenever material is going out, there will be an automatic refill of the material in the system in the warehouse system. So, automated storage and automated

replenishment ok; automated storage automated replenishment this is what the system is all about; right.

Let us see what it means let us look at some diagrams, pictures, and then we will understand, then we will see what to do with it ok. So, let us proceed.

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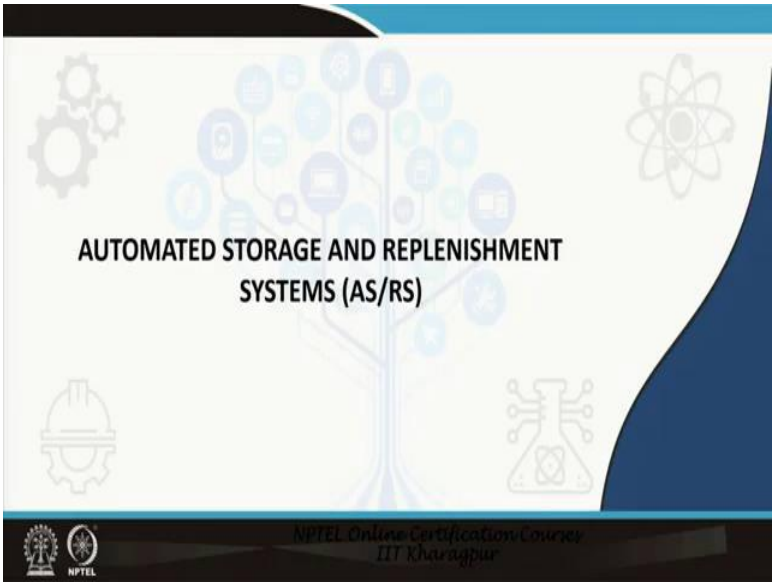

Yeah, automated storage and replenishment system; ok.

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See, this is a picture of a, what is inside; and AS-RS or automatic storage and replenishment system; ok. This is a picture that I borrowed from conveyco.com. Reference is given below.

Conveyco.com as the name signifies it is some sort of a conveyor belt of a thing. Now, see the orange boxes on both the sides, and there is a conveyor belt type of a thing in the middle ok. What does it signify that the products, see and if you look at the right hand side of the picture on the top, there are many ways.

One is the products are stored in these orange coloured boxes, which we can call as a bin; ok. Second is these orange coloured boxes are empty. So, one system products are stored in the orange coloured boxes. Second is the orange coloured boxes are empty. And at the side of these boxes, there are material ok. We will take this second example. This at the side of these boxes, there are materials; ok; there are materials.

So, when an order is generated, these materials basically fall on these orange coloured boxes. They fall on these boxes ok. And this conveyor belt will come in these boxes will go in the conveyor belt, and it will go, so fully automated. I am repeating; ok. You have seen; what is it? you have seen library; you have seen books in the library; ok.

Now, as you those are materials ok. Those are materials in the warehouse. So, what is happening? Below every rack of books there is these types of containers. And actually

this is followed in the library system also in the in huge libraries you will get this system; ok.

What is happening? So, in the racks there are books and below every such rack there is a container, these orange coloured container blue, red, green, whatever orange coloured containers in this example. So, when an order is generated, what will happen, a particular material is required. Here let us take the example of a book. This book is on the rack, below is the container ok. And there are n number of containers.

So, when an order is generated that book will just fall on that container. And then this container will slide out and will come in that conveyor belt that you see there. And then the conveyor belt will start moving, and it will move where to the desk where this book is required automated ok, automated got it. So, this is it.

Now, again what will happen? Once the book is done with done with, then again the same conveyor belt will bring it back, and it will come these plastic buckets will come up there, and the book will move up and somebody will put it back on the rack. Here book is requires a human interface is required, but for materials human interface is not required.

There are instruments which will bring the material here there like say that instruments that will push the material from behind, the material will fall in these boxes, and the box will be on the belt and it will move. So, automated storage automated replenishment. Similarly, when a material comes in it will come in and be at the back, so first in first out. The material that has come in early will come out first; material that is come in late will come out next; ok.

In India we have seen that system first many, many, many, many years back. HMV, I do not know whether you have heard about this company because they are not doing that well now. They were in the cassette industry; for gramophone company, they used to make long playing records, LP records we used to call.

Then the name, but then the brand name the logo was His Masters Voice – HMV you must you in case you have not seen, but you will remember the logo one gramophone is there, and one dog is listening to that gramophone ok. So, that was the logo of HMV.

HMV had a cassette store in Kolkata called Music World ok, and there they had this system. Suppose, every cassette, there will be 5 cassettes ok. So, I pick up as a customer, I pick up 1 cassette look at it go to the cash counter moment, I go to the cash counter, it is scanned and bill billing is done.

When the moment the billing is done that is sending an indication back to the store behind that look one cassette is gone from the 5 cassette block; 5 cassettes were there, one cassette is gone from the 5 cassette block. So, immediately 1 cassette will pop up and go in behind these 4 cassettes that are already there.

So, again another customer picks up the first cassette. So, again sold this cassette goes ok. So, basically automated replenishment ok. So, automated storage automated replenishment same in a large scale mass scale is being followed now in the warehouses that was a miniature scale and this is that was AS/RS system in a retail way. And this is in the warehouse setting ok. So, this is an example of an AS/RS system; ok.

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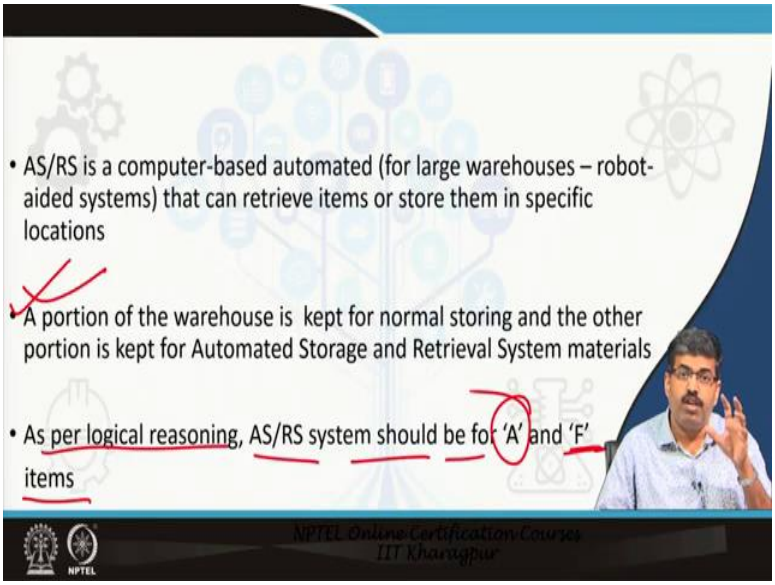

Now, AS RS is a computer-based automated, for large warehouses – it may be robot aided also that can retrieve items or store them in specific locations. So, you just need to put the barcode, and it will take the conveyor belt. You remember the previous diagram sorry the previous diagram this Conveyorco is just an example of a company, it will come in and stop at the exact location where it is supposed to be stored; ok.

So, it is. So, look at the first point AS RS is a computer based automated system that can retrieve items or stored them in specific locations. Now, you will say manual labour also used to do the same thing, yes, but if moment you have automated chances of error is almost zero rather we are going into a 6-sigma setup chances are error is almost 0, and second is speed, and the third is it can take huge load which in a manual setup may not be possible ok. And we will see some more advantages also.

Now, a portion of the warehouse is kept for normal storing and the other portion is kept for automated storage and retrieval system materials. So, one portion is normal storage, and another portion is AS RS. So, because you see why look let us concentrate on this point number 2 for a second ok. Let us concentrate on this point number 2 for a second. A portion of the warehouse is kept for normal storing, and the other portion is kept for automated storage and AS RS material.

Why is it done in that way? Entire warehouse could be automated. Yes, entire warehouse is also automated. But AS RS systems are very costly ok. As you can see from the picture, you have to have a conveyor belt, you have to have bins, you have to have carrying units ok, regular maintenance. When is it feasible? It is feasible when your warehouse is very very busy; tremendously busy warehouse, then it is feasible ok. Otherwise you would not recover the costs, agreed?

So, AS/RS system is feasible only when your warehouse is very busy – number 1. Warehouse is very busy, but what is the cost of the items that you are storing 10 rupees per unit cost, not feasible. So, AS/RS system is feasible when it is busy, when the material stored is very-very costly.

When the material stored is very-very costly that again tells you that you have to have an automated system. Because if the material is not costly, then you do not spend that much money on capital investments; ok.

Third – very busy, costly material ok, so that is what we are saying in point number 3 as per logical reasoning AS RS system should be for A items 20 percent items consuming 80 percent of the value and vice versa and fast moving items as per logical reasoning AS RS system should be for A and F items ok. So, it should so.

What did we learn? If we to have an automated system AS RS system, see automated and AS RS is different; we will come to it a bit later on. Automated means you have a barcode scanner, anything any basic level of automation is also accepted.

Barcode scanner, product goes, you pull it down and bring it back. But AS RS system is no manual intervention, fully machine driven, robot driven, electronic driven, and almost perfection level to almost 6-sigma that is AS RS system, so that is costly.

So, it should be for warehouses which are very, very busy; warehouses that are handling only for those items which are very costly. And the third sometimes for items which are which stacked over, over, over, over. And then items which are quite heavy dimension. If you take it in one forklift only one product can be taken. So, these are things that are for which automated systems have done to increase your productivity; ok.

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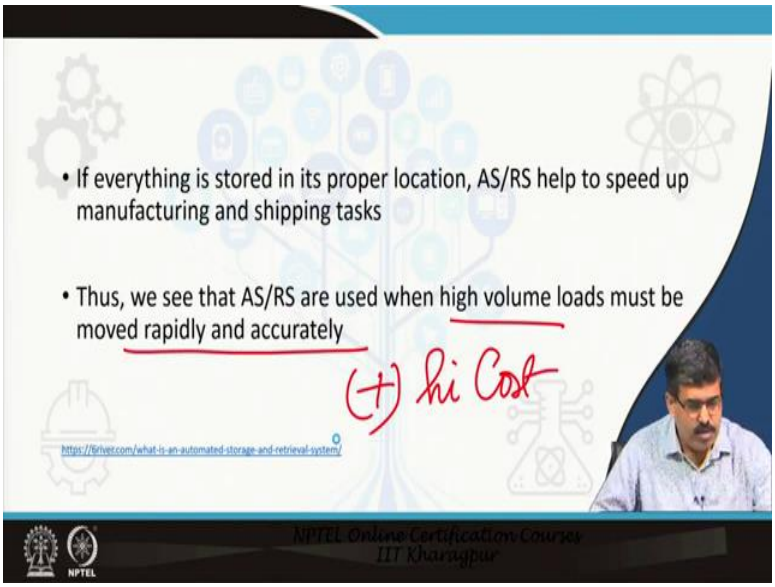

If everything is stored in his proper location that is what we were saying, if everything is stored in his proper location AS RS helps to speed up the manufacturing and shipping tasks ok. So, keep in the proper place, order generated, conveyor belt comes, puts the material, goes. If you have seen Charlie Chaplin's modern times that explains what this speed of an automated system; ok.

So, that is we see that AS RS are used when high volume loads must be moved rapidly and accurately. This is what basically we were saying all along. When you want to move rapidly accurately high volume as well as I will add one more dimension high cost; ok.

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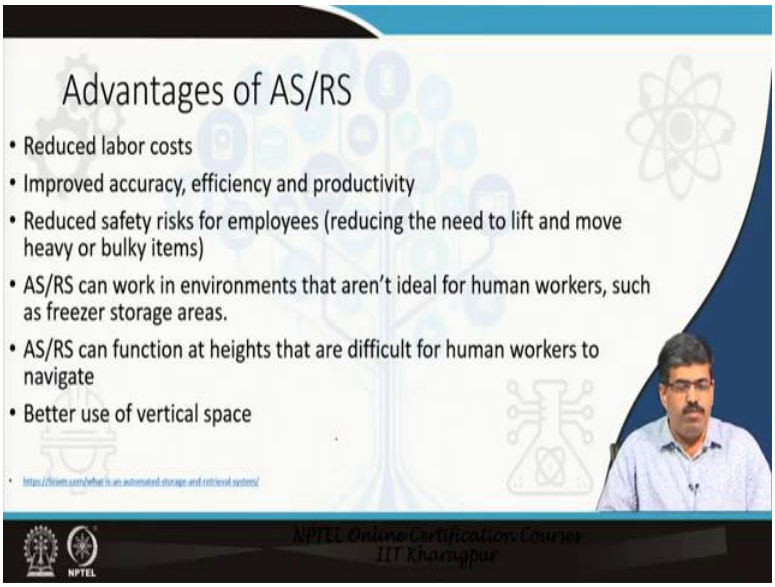

What are the advantages of AS RS systems? Reduce labour cost, improve, reduced labour costs definitely there is no quite doubt on that. Improved accuracy efficiency and productivity ok, yes, again no doubts on that. Reduce safety risk for employees you know when your products are over dimensional, weight, etcetera, there are a lot of safety risks for employees; ok.

The employee may be on top of something he or she might fall ok. So, reduced safety risk for employees, reducing the need to lift and move heavy or bulky items. Lifting you we might catch some problem with your neck I will tell I was telling in the previous day about ergonomic ways of working in a warehouse.

AS RS can work in environments that are not ideal for human working are not ideal for human workers such as freezers storage areas ok. If you see all the nuclear power plants and industries that require some of these radioactive elements all are handled by robots.

Why, because you can these are environment that are not ideal for human workers ok. AS RS can function at heights that are difficult for human workers to navigate, and all this culminates in better use of vertical space better use of vertical space; ok.

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Just take another picture. Again this is of course borrowed from the internet this picture and viastore.com. See if you notice that these racks have these boxes, here is a different system.

Earlier on we said the product will fall on these boxes, and they will go. Now, here the products are already there in these boxes we just seen by a store written down ok. The red coloured boxes, the green colour. And there is a machine here ok. There is a machine here ok, some something like an automated forklift.

So, the machine will adjust itself, and this particular item will be put in this empty space. This particular machine will adjust itself and this particular item will be put in this empty space. Similarly, when you are lifting this particular this machine will move up in height, and this particular item will come in here ok. So, this is fully automated.

Again look at the advantages when the material itself is very heavy, this method is very helpful, fully automated. Because it is programmed, a human hand can pick up this machine instead of this one instead of this one, but this was the correct one ok, but instead of picking this one up it has picked up this. But because it is program because there are barcodes and everything this machine will exactly come up to this location pick it up and go.

So, there is chances of error, is very-very-very-very negligible unless there is a major fault at the programming or the chip level; ok. So, this is another thing right ok. So, this is how the system operates. And if you if you notice actually I do not know whether you are able to see this is the; this is the clangs that are going these black coloured clangs you see.

So, this machine basically can move up to that height. It can move up to that up to this height and adjust itself to the racks difficult for humans. So, these automated machines, automated storage replenishment can really work with very-very much height; it can take advantage of the height of the warehouse; ok.

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What are the disadvantages? Needless to say very high capital cost and regular maintenance ok. Very, very high capital costs, regular maintenance, not only at the machine level, but also your computers, your systems, and servers everything; ok.

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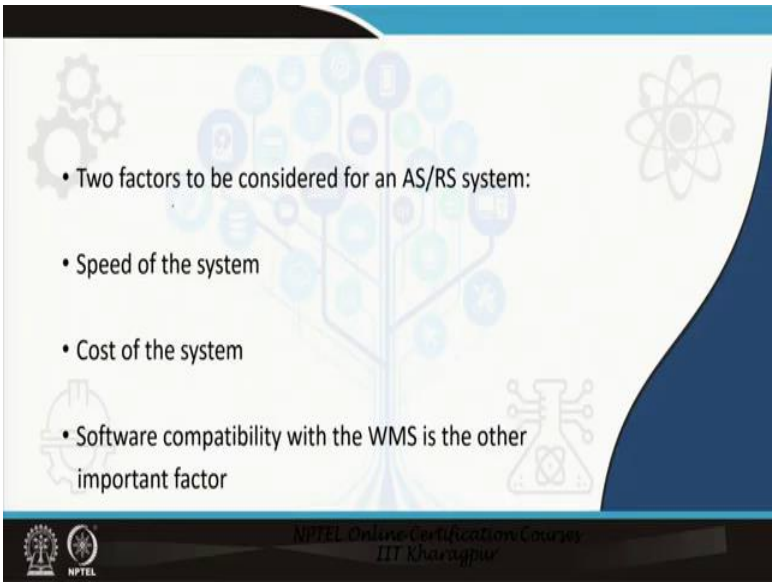

So, two factors that had to be considered for an AS RS system is speed of the system, cost of the system. And software compatibility with the warehouse management system is the other important factor. You already have a warehouse management system in place WMS system. So, the speed of this existing system, the cost and its compatibility with WMS is very-very important; ok.

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Now, the now, so what many organizations are doing is because of the high cost many organizations are using something called as collaborative mobile robots ok. This is an

example of a mobile robot. How is it different from a human operated forklift? These are again laser guided and they can do the same work as that of AS RS system not to that extent, but they are much better than the manual interventions ok. So, they can, here, here is a pallet and there will be a push up here which can push this pallet to the proper place ok. So, it can carry enough heavy load without damaging the workers health and safety; ok.

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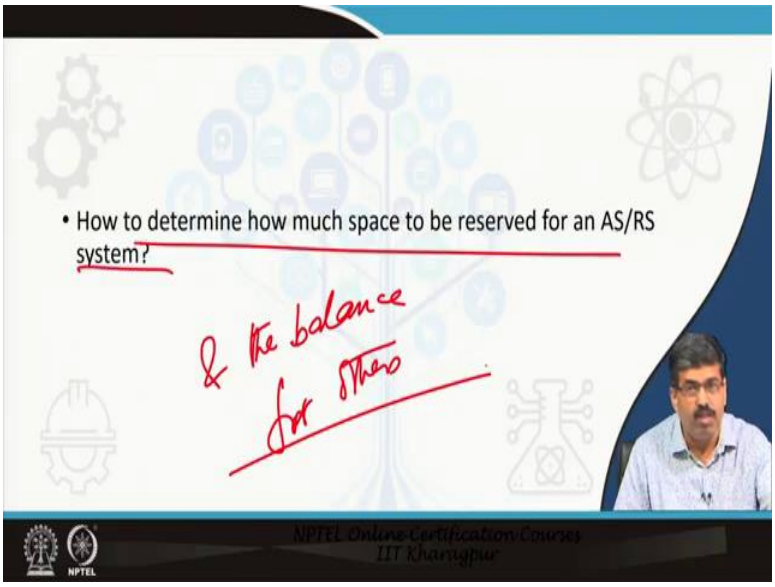

How now this is very important! And let us see how to determine how much space is to be reserved for AS RS system, and the balance is a normal system. And the balance for and the balance for others ok. How to determine how much space? Now, this is just very simple just very simple.

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Looks, this is a warehouse ok; this is a warehouse. What we are saying is this part is AS RS and this part is normal or others right; AS RS and others. Now, this AS RS system what we are saying is how to determine this is 30-70 or 20-80? Tell me, this is dependent on what A B C F S N right combination of this. Remember we need a coloured matrix like this right, coloured matrix like this in the previous class. So, this depends on this thing ok. And that the proportion will be determined by this AF portion of the warehouse.

Let us rephrase it ok. Just, just look just keep this in mind this diagram in mind AS RS 30 percent normal, others is 70. How did we arrive at this 30 percent? You know what will we do? We will basically we will look at the movement pattern of goods in the warehouse; ok.

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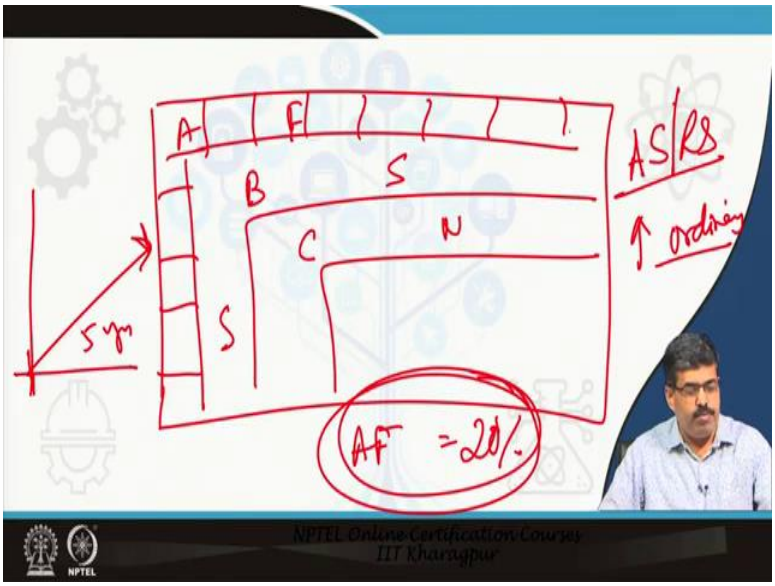

We will look at the movement pattern of goods in the warehouse. And what did we say these were my AF right, these were my AF right. These were my B, these were my AF, these were my BS, the BS and these were my CN.

This was the pattern in which we did. Of your total warehouse how much portion of your products falls under the category AF if your product 20 percent of your products fall under AF category, then 20 percent of your warehouse you can think of putting under AS RS system.

But what should we check? Is the cost of AS RS system higher than ordinary? If yes, then do a long term projection over the next 5 years and see in the long term which is benefiting AS RS system or a normal. If AS RS is benefiting, then reserve 20 percent of your warehouse space for AS RS system ok. So, this is the way you find out the how much portion of a warehouse it should devote to AS RS system; ok.

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These are the reference materials; ok.

Thank you!