

Management Information System
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Week – 05
Module - 01
Lecture - 20
Information Systems for Manufacturing Management

Hi, welcome to Module 1 of Week 5 of our course ‘Management Information Systems’!
Today, we will be dealing with ‘Information Systems for Manufacturing Management’.

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In this lecture, we will deal with associated business processes and the subsystems to support those business processes related to manufacturing management.

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Information Systems for Manufacturing Management

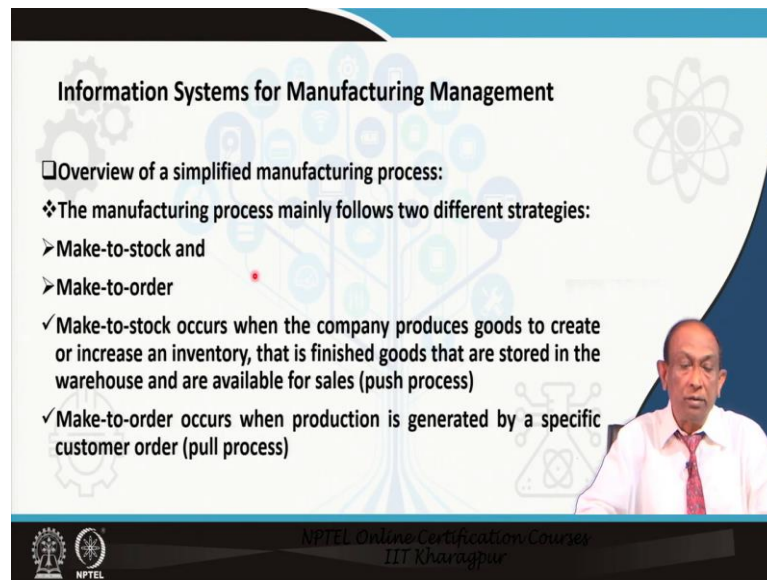
- ❖ The manufacturing/production function is responsible for actually producing the firm's goods and services.
- ❖ Manufacturing activities deal with:
 - planning, development, and maintenance of production facilities,
 - establishment of production goals,
 - acquisition and storage of production materials, and
 - scheduling of equipment, facilities, material and labour required to furnish finished products

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Now, before we discuss the intricacies related with information systems to support manufacturing management, it is necessary to know some details about the manufacturing or so called production function which is adopted in organizations. You see the manufacturing and production function in any organization is responsible for actually producing the firm's, goods and services.

Manufacturing activities basically deal with planning, development and maintenance of production facilities. Establishment of production goals, acquisition and storage of materials needed for production. Scheduling of manufacturing equipment's, facilities, material as well as labour required to furnish finished products.

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Information Systems for Manufacturing Management

- Overview of a simplified manufacturing process:
 - ❖ The manufacturing process mainly follows two different strategies:
 - Make-to-stock and
 - Make-to-order
 - ✓ Make-to-stock occurs when the company produces goods to create or increase an inventory, that is finished goods that are stored in the warehouse and are available for sales (push process)
 - ✓ Make-to-order occurs when production is generated by a specific customer order (pull process)

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Now, let us start with overview of a simplified manufacturing process. The manufacturing process in a firm mainly follows either of these two different strategies or maybe both the strategies, depending on the type of products that they are manufacturing. So, the broad strategies are make to stock and make to order.

Although there are several variants of make to order strategies but in this course we will restrict ourselves only with the discussion on ‘make to order’. Because, there are variants like assembly to order, configure to order, engineer to order; now, all those are details pertaining to a manufacturing management course. But, here we just need to get some idea about the manufacturing processes, so that we really understand the role information systems play in supporting that manufacturing process.

Make-to-stock production process occurs when a company produces goods to create or increase an inventory that is finished goods which are stored in the warehouse and are available for sales. This is basically also known as push process, here the company is producing the products in anticipation that customers will have demand for these products and they will buy those products.

If customers really do not buy those products, then these products will remain as finished good stock and company will have to bear the cost of holding that finished goods inventory. Make-to-order process occurs when production is generated by a specific customer order.

This is also basically known as pull process, as if the customer is pulling the product from the assembly line or from the factory on to them. So, here production takes place based on confirmed order from the customer. And, hence the question of holding finished goods inventory is minimized or eliminated.

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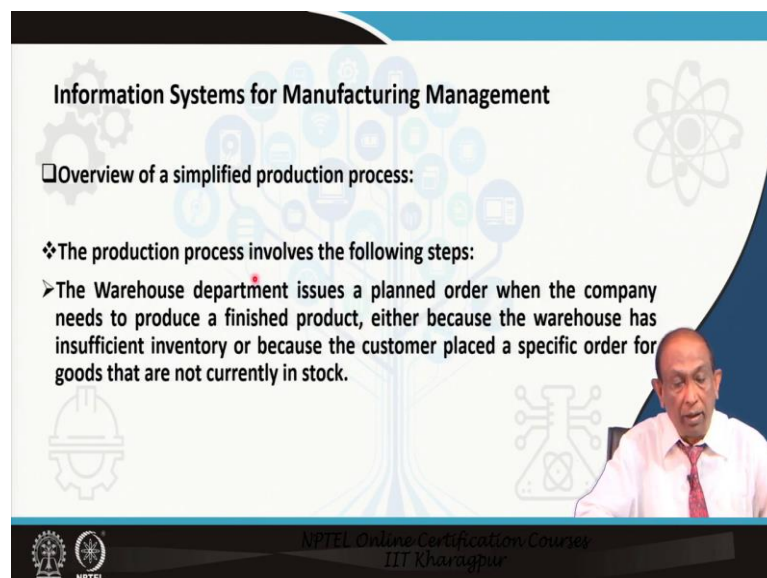
□ Overview of a simplified production process:

- ❖ Manufacturing companies that produce their own goods manage their interdepartmental production process across the Production and Warehouse departments.

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Manufacturing companies that produce their own goods manage their interdepartmental production process across the production and warehouse departments, this we must understand.

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Information Systems for Manufacturing Management

□ Overview of a simplified production process:

- ❖ The production process involves the following steps:
 - The Warehouse department issues a planned order when the company needs to produce a finished product, either because the warehouse has insufficient inventory or because the customer placed a specific order for goods that are not currently in stock.

The slide features a background with various icons including gears, a hard hat, a circuit board, and a molecular structure. A small inset video shows a man in a white shirt and red tie speaking. The bottom of the slide includes the NPTEL logo and the text 'NPTEL Online Certification Courses IIT Kharagpur'.

The production process involves the following steps, when the customer places an order on to the firm; the first thing that is checked is that whether sufficient stock is available in the warehouse or not. So, this customer order information is passed on to the warehouse.

The warehouse department issues a planned order when the company needs to produce a finished product, either because the warehouse has insufficient inventory or because the customer placed a specific order for goods that are not currently in stock. That means, this planned order will either get converted into a production order or it will result into a purchase order or a procurement order.

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❖ Overview of a simplified production process:

- Once the planned order reaches Production, the production controller authorizes the order and issues a production order, which is a written authorization to start the production of a certain amount of specific product.

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So, once this planned order reaches the production department, the production controller authorizes the order and issues a production order which is a written authorization to start the production of a certain amount of specific product.

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❖ Overview of a simplified production process:

- To assemble a finished product, Production department requires a number of materials (or parts)
- To acquire these materials, Production department generates a material withdrawal slip, which lists all of the needed parts, and forwards it to the Warehouse

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To assemble a finished product production department requires number of materials or parts in terms of say what we call components as well as raw materials. Now, to acquire these materials, production department will generate a material withdrawal slip which will list all of the needed parts and then this document will be forwarded to the stores or the warehouse.

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Information Systems for Manufacturing Management

❖ Overview of a simplified production process:

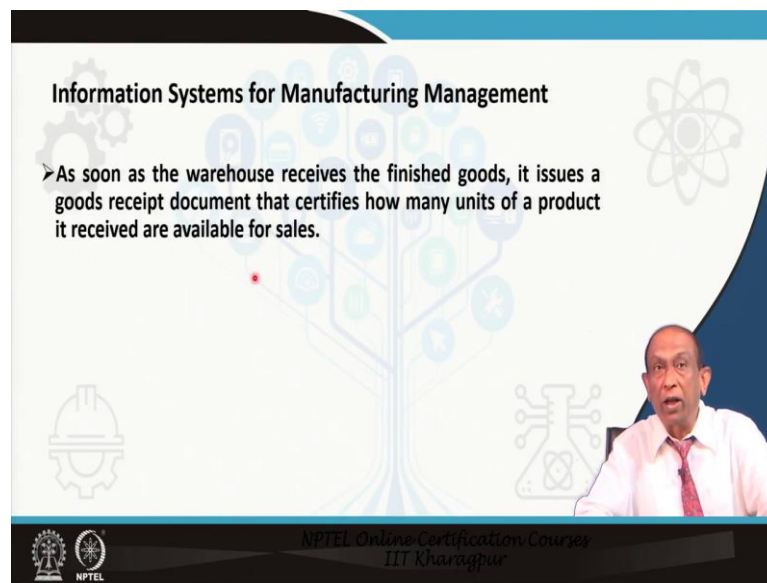
- If the parts are available in the Warehouse, then the Warehouse delivers them to Production. If the parts are not available, then the company must purchase them via the procurement process.
- After Production has created the products, it updates the production order specifying that, as planned, a specific number of units of product can now be shipped to the Warehouse.

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If the parts are there in the stores or in the warehouse then the warehouse will deliver it to the production department. But if the parts are not available then the company have to

procure them, they have to purchase them through the procurement process. After production department has created the products based on this production order, it updates the production order specifying that as planned, a specific number of units of product can now be shipped to the warehouse and that is stocked in the warehouse.

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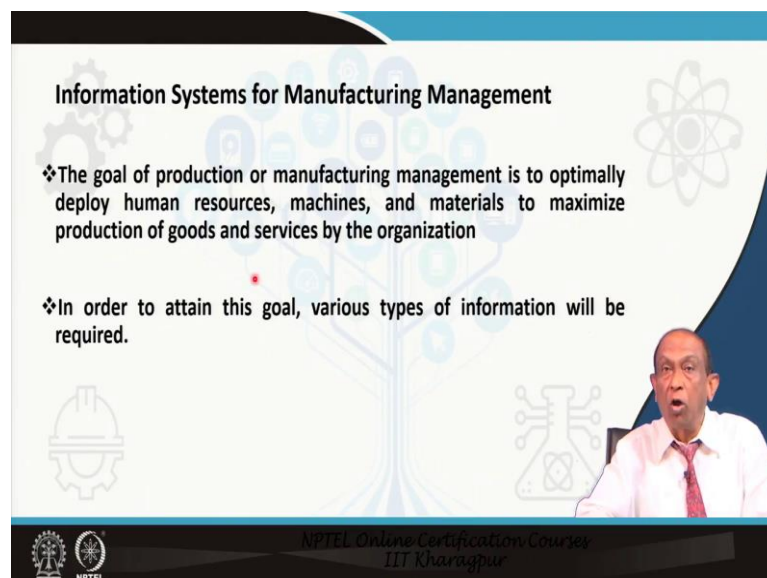
Information Systems for Manufacturing Management

- As soon as the warehouse receives the finished goods, it issues a goods receipt document that certifies how many units of a product it received are available for sales.

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As soon as the warehouse receives the finished goods, it issues a goods receipts document that certifies how many units of a product it has received and those are available for sales.

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Information Systems for Manufacturing Management


- ❖ The goal of production or manufacturing management is to optimally deploy human resources, machines, and materials to maximize production of goods and services by the organization
- ❖ In order to attain this goal, various types of information will be required.

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So, this in the short is the overall manufacturing process or the production process that takes place in any organization. And, the goal of production or manufacturing management is to optimally deploy human resources, machines and materials to maximize production of goods and services by the organization, preferably at the least cost. That is why we have mentioned that optimally we are deploying all the resources that are necessary, to produce this goods and services.

So, in order to attain this objective or this goal various types of information will be required. And, the primary objective of any information systems that supports this production management function or manufacturing management function is to basically provide all those information which will be required for optimal production of goods and services.

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The slide is titled "Information Systems for Manufacturing Management". It features a background with a stylized tree of nodes and icons representing manufacturing and technology. The text on the slide is as follows:

- ❖ Strategic Information for:
 - Location of new production facilities
 - Design of new products (use of CAD)
 - Yearly and monthly production quotas and alternate schedules
 - Policies on machine replacement, augmentation, and modernization

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Now, the information which is needed by the production department or any organization for manufacturing their products and services can be classified in various categories. First is the strategic information; that means, information which is required for achieving the long term plans or goals of the organization.

Example of strategic information are location of new production facilities, where do I locate a new factory or a new warehouse or where do I locate this kind of production equipment? Then, design of new products for that we use computer aided design and that also is basically supported by this information systems for manufacturing management.

The other information requirement for strategic purposes are the yearly and monthly production quotas and alternate schedules for manufacturing those products. Policies on machine replacement, augmentation of resources, modernization of equipment.

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❖ **Strategic Information for:**

- Introduction of new production technologies, acquisition, and mergers
- Identification of best product mix
- Policy on quality assurance

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Introduction of new production technologies, acquisition and mergers of different units or companies, identification of best product mix, policies on quality assurance; these are at the different kinds of you know information that is required for strategic purposes.

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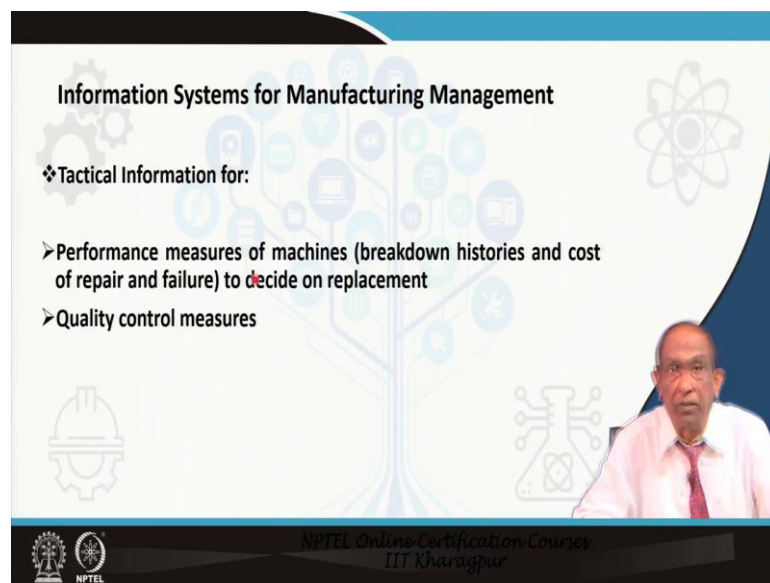
❖ **Tactical Information for:**

- Identification and control of areas of high cost such as WIP inventories
- Identification of critical bottlenecks in production
- Identification of alternate production schedules based on tools, machines, material, and personnel availability

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Now, we come to tactical information requirement; identification and control of areas of high cost for example, how to minimize work in progress inventories. Identification of critical bottlenecks in production, identification of alternate production schedules based on availability of tools, machines, materials and personnel; these are examples of tactical information required for a manufacturing function. And, all these are being supported through this information systems for manufacturing management or production management.

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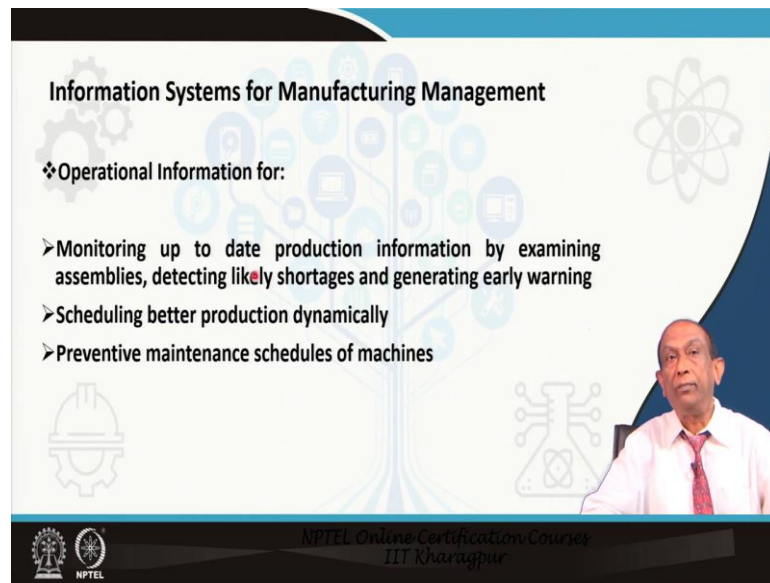
The slide is titled "Information Systems for Manufacturing Management". It features a background with a stylized tree of icons representing various manufacturing and information systems concepts. The text on the slide is as follows:

- ❖ Tactical Information for:
 - Performance measures of machines (breakdown histories and cost of repair and failure) to decide on replacement
 - Quality control measures

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Tactical information comprises of computing or reporting on the performance measures of machines depending on the breakdown histories and cost of repair and failure. This will also help the managers to decide on replacement of machines. So, whenever a failure occurs for a machine or whenever there is a breakdown all the associated data is stored in the manufacturing management information systems database associated with storage of cost of repair and failure.

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Information Systems for Manufacturing Management

❖ Operational Information for:

- Monitoring up to date production information by examining assemblies, detecting likely shortages and generating early warning
- Scheduling better production dynamically
- Preventive maintenance schedules of machines

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Operational information; that means, the information which are supported by the manufacturing systems for performing the daily or say weekly or routine operations comprise of monitoring up to date production information by examining assemblies, detecting likely shortages and generating early warning.

Scheduling better production in a dynamic manner, determining preventive maintenance schedules of machines; all these are examples of operational information which is required for effectively performing the manufacturing management function.

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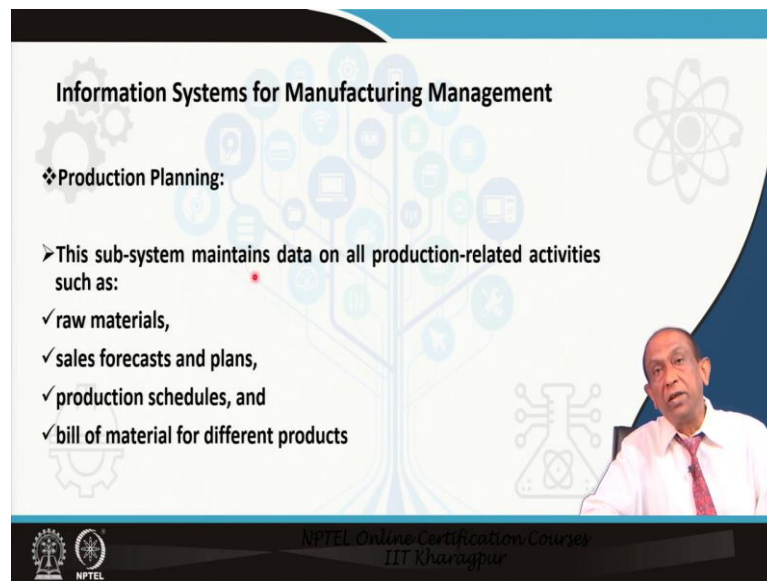
❖ Operational Information for:

- Monitoring tools, machines, and human resources availability
- Ensuring quality at each step in production
- Machine control (i.e., controlling the action of machines and equipment)

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Monitoring tools, machines and availability of human resources; the primary requirement for operational function, ensuring quality at each step in production, controlling the action of machines and equipment on a daily basis. Now, for all these information is required, and this kind of information is being supported by the manufacturing management information system.

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Information Systems for Manufacturing Management

❖ **Production Planning:**

➤ This sub-system maintains data on all production-related activities such as:

- ✓ raw materials,
- ✓ sales forecasts and plans,
- ✓ production schedules, and
- ✓ bill of material for different products

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Information systems for manufacturing management can be divided into various subsystems. One of the most important subsystem is the production planning subsystem. This subsystem maintains data on all production related activities; for example, how much raw materials is there, how much raw materials is needed.

Production planning also generates sales forecasts and plans, because that is the important input for generating production schedules. And, bill of material for different products that is also one prime requirement, maintenance of the bill of material that is also facilitated by this kind of information system.

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Information Systems for Manufacturing Management

❖ Production Planning:

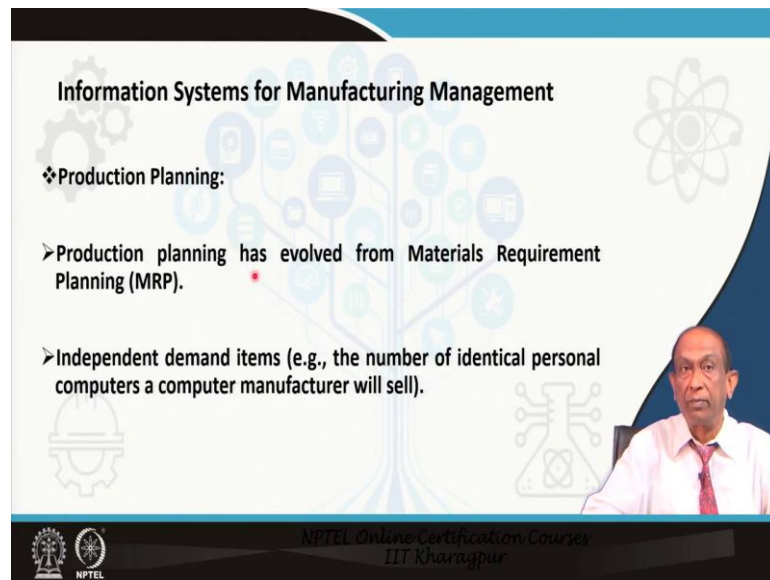
- This sub-system also maintains data on:
 - orders for repetitive manufacturing,
 - costs of production data, and so on.
- It is a high-level module for managing the production function including activities such as routing, scheduling, and loading.

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Production planning subsystem maintains data on orders for repetitive manufacturing, costs of production data and so on. It is a high level module for managing the production function including activities such as routing. Routing means all those that the route that the product will follow in order to get converted from the raw materials to the finished good stage; that means, through which machines and in what sequence the product will flow; ok.

So routing, scheduling and loading are very important functions for a production manager and the production planning subsystem provides the required information for performing those activities.

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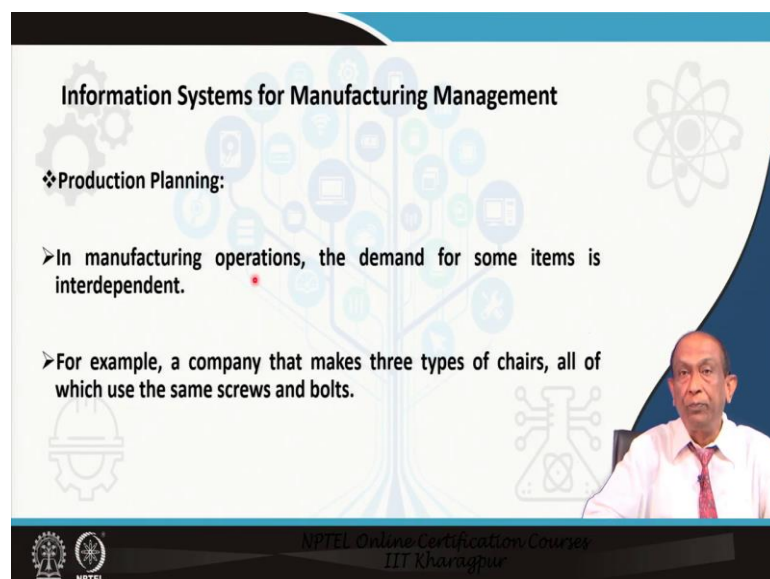
❖ **Production Planning:**

- Production planning has evolved from Materials Requirement Planning (MRP).
- Independent demand items (e.g., the number of identical personal computers a computer manufacturer will sell).

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Production planning has evolved from materials requirement planning which is short commonly known as MRP that is ‘materials requirement planning’. In MRP, the first concept is the concept of independent demand items. Independent demand items are those items for which the demand does not depend on anything else. For example, for say a company like Dell or HP, the number of identical personal computers, a computer manufacturer will sell, their demand is basically independent demand.

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Information Systems for Manufacturing Management

❖ **Production Planning:**

- In manufacturing operations, the demand for some items is interdependent.
- For example, a company that makes three types of chairs, all of which use the same screws and bolts.

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In order to get the idea of this MRP after independent demand items, we need to know what are dependent demand items or interdependent items. For example, a company that makes three types of chairs, all of which use the same screws and bolts.

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❖ **Production Planning:**

- In this case, the demand for screws and bolts depends on the total demand for all three types of chairs and their shipment schedules.
- The planning process that integrates production, purchasing and inventory management of interdependent items is called materials requirement planning (MRP).

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In this case, the demand for screws and bolts depend on the total demand for all three types of chairs and their shipment schedules. So, you see the demand for screws and bolts, it will get generated based on the total demand for all the three types of chairs and their shipment schedules. So, these they are these screws and bolts are basically interdependent demand items.

So, we have the concept of independent demand type of items and interdependent demand type of items. And, the planning process that integrates production, purchasing and inventory management of interdependent items is the primary focus of materials requirement planning.

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Information Systems for Manufacturing Management

❖ **Production Planning:**

- The main functions of MRP are,
 - to monitor stocks and
 - to determine which material you need in what quantity at what time, and
 - to create the corresponding order proposals from this subsystem
- ✓ Production orders
- ✓ Purchase orders

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So, the main functions of a material requirement planning process are to monitor stocks and to determine which material the managers need in what quantity, at what point of time. And, then the MRP system helps them to create corresponding order proposals from the subsystem. So, order proposals will comprise of as we had already discussed, production order and purchase orders.

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Information Systems for Manufacturing Management

❖ **Production Planning:**

- In MRP, the subsystem compares available stock or the scheduled receipts from purchasing or production with planned requirements in the net requirements calculation.
- $\text{Net Requirement} = \text{Planned Requirement} - (\text{Available stock at warehouse} + \text{Scheduled receipts from purchasing or production})$
- Planned Requirement is calculated through explosion of bill of materials

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In MRP, the subsystem compares the available stock; that means, the stock which is present in the stores plus it will also consider the scheduled receipts from the purchasing


the or production function. See the scheduled receipts are also known as the pipeline stock; that means, the company has placed order on to its suppliers and the suppliers has not yet delivered that stock; that means, that stock is in transit. It will be also known as the pipeline stock; ok.

So, MRP will see how much stock is there in the stores, how much they are yet to receive; that means, what is the pipeline stock and what is the plan requirements, because finally, it has to calculate the net requirements. The net requirement is calculated based on the formula which is net requirement equals the planned requirement minus available stock at warehouse, that is available stock at stores plus the scheduled receipts from purchasing or production. Why production?

Because, if the company is not purchasing those materials from any outside vendor, then the production department has to manufacture it; so that means, the source is the in house production department. And, plan requirement is then calculated through explosion of bill of materials.

So, explosion of the bill of materials will give you the planned requirement, from the planned requirement you have to subtract the total stock comprising of the stock at stores plus the pipeline stock. Now, you got to know; what is this explosion of bill of materials; ok.

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Information Systems for Manufacturing Management

❖ **Production Planning:**

- Bill of Material (BOM) is a complete, formally structured list which make up the components of a product or assembly.
- The list contains the material identification number of each item, together with the quantity, unit of measure, and indicator for purchase or production.
- We can explode a BOM to show the total quantity of each item required to meet the planned requirement of the finished product.

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The slide features a background with faint icons of gears, a network diagram, and a molecular structure. A small inset image of a man in a white shirt and red tie is visible in the bottom right corner of the slide content area.

Now, then in that case you have to have some idea about what is a bill of material? A bill of material is a complete formally structured list which make up the components of a product or assembly. In the computer database, the bill of materials is stored in the form of an inverted tree structure. The bill of material is basically a list containing the material identification number of each item together with the quantity, the unit of measure and indicator for purchase or production.

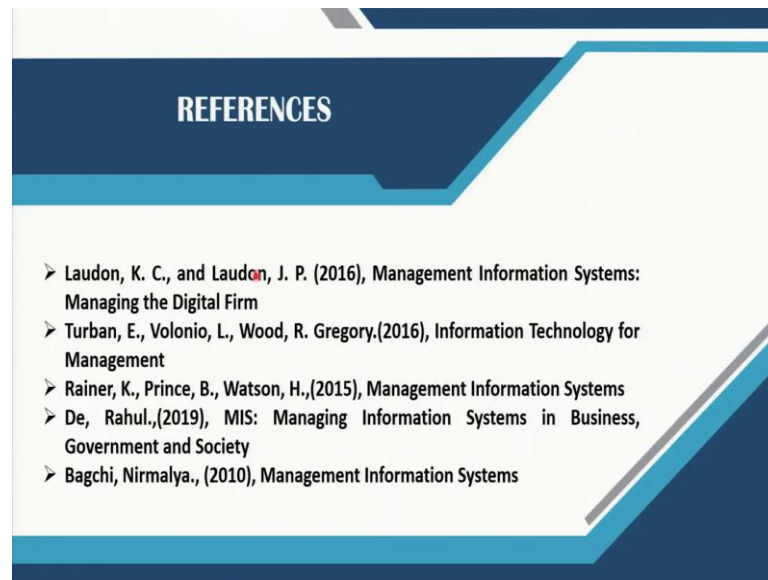
That means, whether the item we will manufacture it in house or we will procure from some outside vendor is also being indicated in the bill of material against a part. We can explode a bill of material to show the total quantity of each item which will be required to meet the planned requirement of the finished product. For example, suppose say a truck; ok, it will consist on the first level assembly; consists of an engine; ok, may be say crankshaft, connecting rod, and other first level assembly components.

Now, if I have to produce 100 trucks, then I will require 100 engines. Like this, if I have to manufacture 100 engines, how many components will be required for manufacturing; 1 – engine should be known first, and then the corresponding multiplication has to take place that is basically the explosion for any item. So, the exploded requirements must be known to compute the plan requirement for that item.

And, we got to know that whether that item we will procure from outside vendor or we are manufacturing it in house. So, there is a tag against every item which is listed in the bill of materials, that whether that item will be purchased from an outside vendor or will be made in house. Once, we explore the bill of materials we know what is the total quantity or that that needs to be planned.

So, that plan requirement if we know from there, if we subtract what is the available stock at stores plus the pipeline stock; we will get the net requirement for that part. Sometimes what happens, that in computing the net requirement we also take into consideration the safety stock that is needed for every item. So, in that case the net requirement will be the plan requirement minus available stock at stores minus pipeline stock plus the safety stock which is required.

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So, this way we compute the net requirement and all these information will be generated or supported by the information systems for manufacturing management. So, this is the first part of manufacturing management information system.

Thank you all! These are the references.