

Management of Inventory Systems
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Lecture - 41
Basics of Purchasing Management

So, during this week, we are going to discuss an important topic that is Basics of Purchasing Management.

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Basics of Purchasing Management

- **Lecture-1:** Purchasing and Inventory Management, Purchasing and Other Departments/Functions, Purchasing's role in the Total System
- **Lecture-2:** Performance of an Organization and Purchasing Function, Objectives of Purchasing, List of Purchasing Activities
- **Lecture-3:** Basic Purchasing Process, Purchasing Cycle and Operations, Buying Agreement and Systems Subcontracting
- **Lecture-4:** Analytical Approach to Make or Buy Decision, Selection of Suppliers, Comprehensive Method for Supplier Performance Measurement and Evaluation
- **Lecture-5:** Measuring Purchasing Performance and its relationship with Inventory Control System, Case Examples

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As we have already pointed out that for management of inventory systems, a support from the purchasing department is a must and that is why you will find many time even the ordering policies for a specific inventory item is may be referred to as the purchasing policy. And as we have actually classified the inventory problems, we will find that one important factor which determines the class of problem that is the whether the supply is a outside supply or the self supply.

So, outside supply is essentially it is related to say the purchasing of the item and that is why you know in any say materials management exercises or when you deal with the management of inventory systems related problems. So, you must have a thorough idea about the purchasing management.

Now, during this week, there will be 5 lecture sessions and I will just tell you the specific topics that we have included in all these lecture sessions. So, in lecture-1, we will be discussing purchasing and inventory management to in which way they are linked, purchasing and other departments of the functions in an organizations. So, how the purchasing is has got a relationship with the other departments?

Then, purchasing roles in the total systems so, this will be the coverage in during a in lecture-1. In the next lecture session, we will talk about the performance of an organization and purchasing function, objectives of purchasing, list of purchasing activities. During lecture-3, the basic purchasing process will explain what are the phases involved and the concept of purchasing cycle will explain and what are the operations involved in the purchasing cycle you will come to know. And two specific issues namely, the buying agreement and the systems subcontracting also we will discuss.

In the next lecture session, we will discuss analytical approach to make or buy decision, selection of the suppliers is an important issue in fact, and we will also discuss at length, the comprehensive method for supplier performance measurement and evaluation. And during the last lecture session, we will take up the issue of measuring purchasing performance or the purchasing department performance and its relationship with inventory control system and wherever were the possible we will refer to the relevant case examples. Now, in the today's lecture session, we will refer to 3 specific topics.

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Basics of Purchasing Management

- ✓ Purchasing and Inventory Management
- ✓ Purchasing and Other Departments/Functions
- ✓ Purchasing's role in the Total System

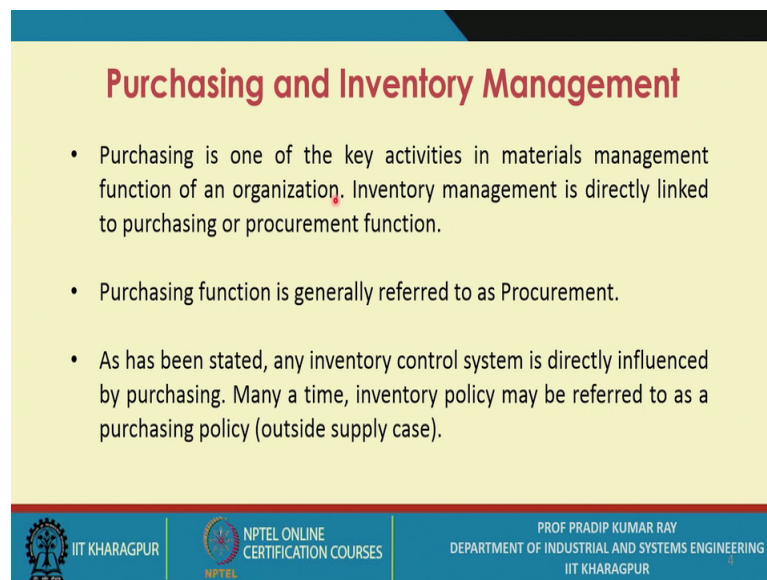
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The first one we are going to discuss that is Purchasing and Inventory Management in which way they are linked. Then, to what extent you know the other departments and the functions performance is related to the purchasing the department's performance and what is the purchasing's role in the total system?

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Purchasing and Inventory Management

- Purchasing is one of the key activities in materials management function of an organization. Inventory management is directly linked to purchasing or procurement function.
- Purchasing function is generally referred to as Procurement.
- As has been stated, any inventory control system is directly influenced by purchasing. Many a time, inventory policy may be referred to as a purchasing policy (outside supply case).

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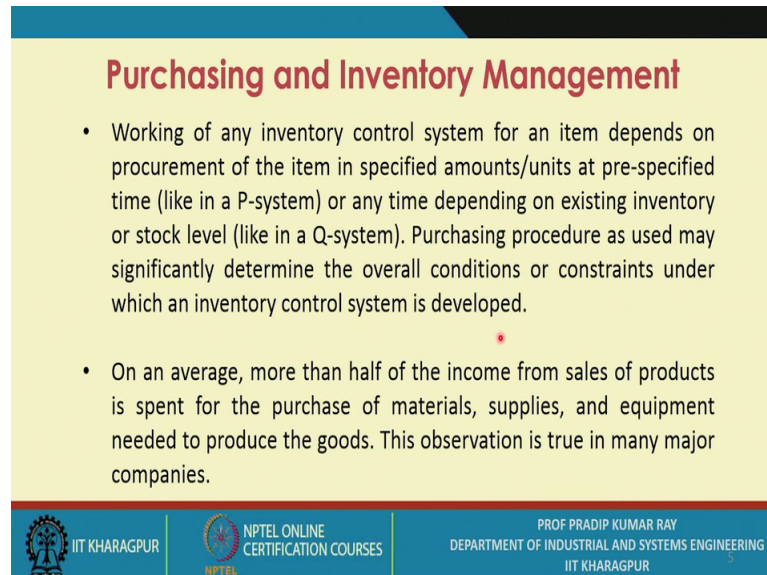
Now, certain remarks, we are going to make here when we talk about the relationship between Purchasing and Inventory Management. Now, the purchasing is one of the key activities in materials management function of an organization. You are already aware of what are the specific areas, where we concentrate when we discuss the materials management systems of an organization. So, you might have noticed that one important say the area in materials management is the purchasing management or purchasing.

The inventory management is directly linked to purchasing or procurement function and purchasing function is generally referred to as procurement function and you know that when you believe in the concept of the quality loop for an organization; so as per you know the cue 1994 standards, there are 11 you know the functions of an organization. And one of the important the functions is the Procurement function.

So, in the standard, this is referred to as the procurement; but many a time, it is referred to as the purchasing functions of the purchasing department. As has been stated, any inventory control system is directly influenced by purchasing. Many a time, inventory policy may be referred to as a purchasing policy. I have already mentioned that means,

when you say that inventory policy is the purchasing policy it means you are referring to outside supply case.

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Purchasing and Inventory Management

- Working of any inventory control system for an item depends on procurement of the item in specified amounts/units at pre-specified time (like in a P-system) or any time depending on existing inventory or stock level (like in a Q-system). Purchasing procedure as used may significantly determine the overall conditions or constraints under which an inventory control system is developed.
- On an average, more than half of the income from sales of products is spent for the purchase of materials, supplies, and equipment needed to produce the goods. This observation is true in many major companies.

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Now, working of any inventory control system for an item depends on procurement of the item in specified amounts of the units. And the several you know the modules you have gone through by this time and you are aware of the parameters of the inventory control systems like the ordering quantity or the reorder point etcetera.

So,. So, working of any inventory control systems depends on procurement of the item under consideration in specified amounts or the units at pre specified time like a P-system or any time depending on existing inventory or stock level. That means, when you define the reorder point. So, if the inventory level or inventory position touches so the reorder point; obviously, you are supposed to place an order or the purchase order. So, this is the system of a say procurement when we use the Q-system of inventory control. Now, the purchasing procedure as used may significantly determine the overall conditions or the constraints under which an inventory control system is developed.

Like in the on the previous lecture sessions, in the other weeks what we have mentioned that you need to determine or the parameters of an inventory control system under constraints and once such constraints could be the that the number of the purchase orders to be placed; maybe this number is restricted to some number and obviously, when this

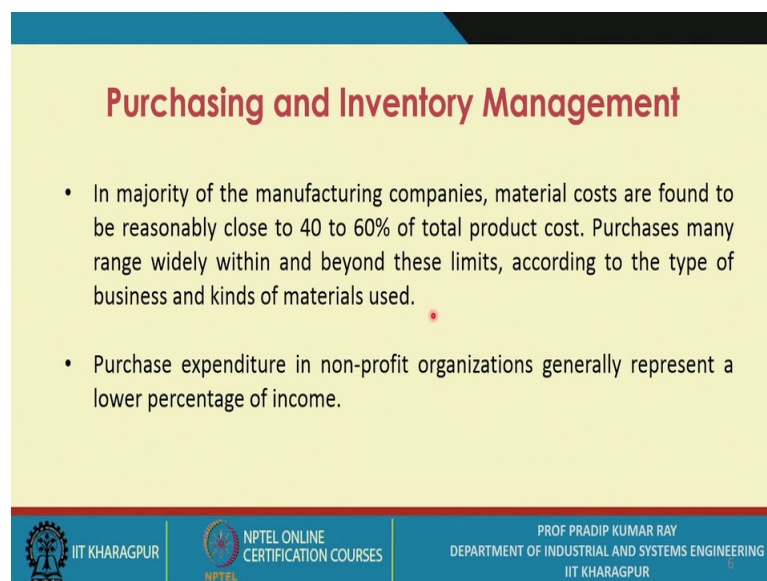
number is restricted and the number of purchase orders; that means, we are referring to the operations of the purchasing department.

And suppose what sort of the systems you follow; whether it is a computer based systems or the manual system, how much the paper work you need to have for placement of an order etcetera. Many such the factors actually may determine that how many orders in a given time period you are able to you are able to place. So, the purchase orders you are able to place? So, that is why you know the purchasing procedure as used may significantly determine the overall conditions or the constraints under which an inventory control system is developed.

On an average more than half of the income from the sales of products is spent for the purchase of material supplies and equipment needed to produce the goods and this is an important observation. That means, if you collect data on the relevant parameters, you may have you when majority of the cases you have this observation.


So, this observation is true in many major companies; that means, if you earned just 1 rupee and also suppose your within many cases suppose the sales is just 1 rupee. Now, out of 1 rupee, you spend at least a 50 paise for purchase. So, in many cases this may be more, but on an average it is around 50 percent.


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Purchasing and Inventory Management

- In majority of the manufacturing companies, material costs are found to be reasonably close to 40 to 60% of total product cost. Purchases many range widely within and beyond these limits, according to the type of business and kinds of materials used.
- Purchase expenditure in non-profit organizations generally represent a lower percentage of income.

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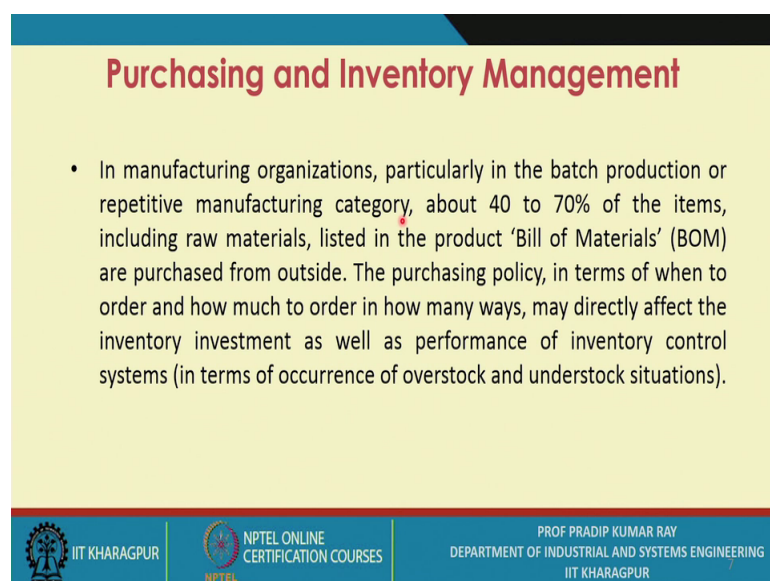
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So obviously, you need to look into the purchasing of procedures; whether the kinds of purchasing systems you employed; whether this purchasing system is acceptable and whether there is any scope for improvement in the purchasing procedure or not. In majority of the manufacturing companies, now the manufacturing companies represent as a special type of situation or special type of condition. In majority of the manufacturing company's material costs are found to be reasonably close to 40 to 60 percent of the total product cost and through empirical analysis, you can arrive at this conclusion.

For some cases, it could be 40 percent and for some other cases, it could be as high as 60 percent of the total product cost. Purchases may range widely within and beyond these limits according to the type of business and the kinds of materials used. So, these are the 2 important factors; one is what is the type of the business and the depending on the type of business, you may have just 1 specific type of purchasing system and similarly, depending on the type of the materials of the types of the products you manufacture, you may have to opt for a set of say the specific purchasing procedures.



So, the purchase expenditures in nonprofit organizations like the service organization, like educational institutes generally represent a lower percentage of income ok. So, these are all general observations.

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Purchasing and Inventory Management

- In manufacturing organizations, particularly in the batch production or repetitive manufacturing category, about 40 to 70% of the items, including raw materials, listed in the product 'Bill of Materials' (BOM) are purchased from outside. The purchasing policy, in terms of when to order and how much to order in how many ways, may directly affect the inventory investment as well as performance of inventory control systems (in terms of occurrence of overstock and understock situations).

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But whatever may be your observations one thing you must conclude that is the without an effective purchasing management system, you cannot have an effective and performing a well performing inventory management systems. In manufacturing organizations, particularly in the batch production or the repetitive manufacturing category, there are you know essentially the various types of manufacturing systems are classified under 3 categories; like it could be the job shop, it could be the batch production or it could be continuous manufacturing.

So, what we find that the batch production actually the represents almost 70 to 80 percent of the total manufacturing systems in any country. So, when you refer to the batch production or repetitive manufacturing organization, about 40 to 70 percent of the items including raw materials listed in the product 'Bill of Materials'. Bill of materials system already you have come across, when we studied the MRP or MRP-2. So, you have you know what is bill of materials.

Now, about 40 to 70 percent of the items as listed in the bill of materials for the n products are purchased from outside. So, any important so, the any item you get in the bill of material, first thing what you need to or the first decisions you have to make that is for the given item whether you will go for buying it from outside the source or you will make out or you will make it or you will manufacture it with your in house facilities of the production system.

So, this is referred to as the make or buy decision and make or buy decision is actually is made by the purchases purchasing department. So, in the subsequent lecture the classes, I will be referring to this particular concept make or buy decision and how to arrive at this decision given an item are the listed in the Bill of Materials.

The purchasing policy in terms of when to order and how much to order, in how many ways may directly affect the inventory investment. That means how do you measure inventory investment actually at any point in time; it may be measured by the average inventory which you hold in monetary terms. So, these are actually you know directly affects the inventory investment as well as the performance of inventory control systems in terms of the occurrence of overstock and under stock situation. If your purchasing system is bad, then it may result into under stock situation or the overstock situation.

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Purchasing and Inventory Management

- Proportion of purchase cost in total cost of products or services varies from one industry to another. For example, purchase cost of material where single raw material makes up the bulk of the finished product may be as high as 85% of the finished product cost. For extractive industries, such as mining or oil production, where the product is manufactured from purchased materials, but comes from natural deposit, purchased material generally account for about 25% of the sales.

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Proportion of purchase cost in total cost of products or services varies from one industry to another it is obvious. So, if you the different industries have different characteristics. So, that is why you know the cost structures are also different. For example, purchase cost of material where single raw material makes up the bulk of the finished product. These cases you come across.

Now, here the purchase cost of material may be as high as 85 percent of the finished product cost; that means, essentially it is a raw materials intensive production system and only the few kinds of raw materials you require. There are many such products, you can name them and you can identify those products also. For extractive industries such as mining or oil production, where the product is manufactured from purchase materials; I do not need to elaborate, but comes from natural deposits, purchased material generally account for about 25 percent of the sales. Is it ok? So, this is for the extractive industries.

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Purchasing and Inventory Management

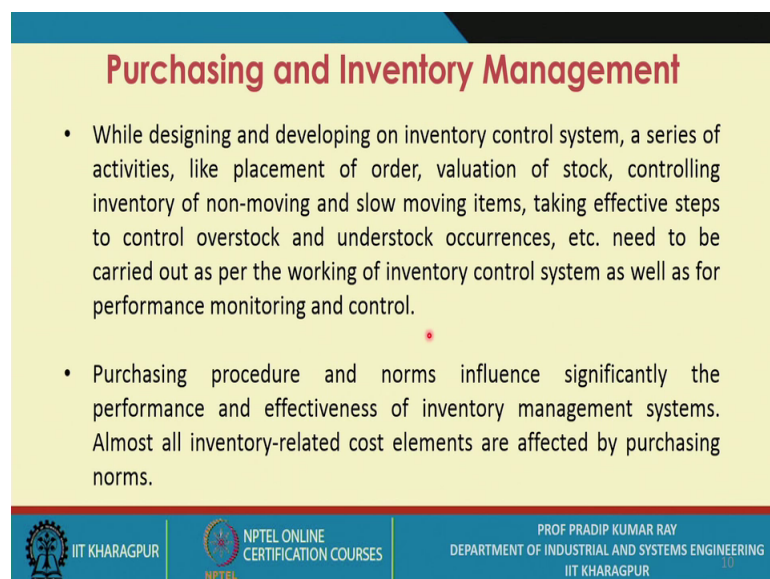
- Purchases in labour-intensive industries are relatively low, say 20%, in proportion to the total cost of doing business. In manufacturing industries, the ratio of purchased materials to total product cost is generally at least 50%. When components are procured in fabricated form in such industries, purchase cost proportion may go upto 60%.

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Purchases in labor-intensive industries, there are many such industries throughout our country are relatively low, say 20 percent, in proportion to the total cost of doing business. In manufacturing industries, the ratio of purchase materials to total product cost is generally at least 50 percent. When components are procured in fabricated form; many a time, we have these sort of systems. When components are procured in fabricated form in such industries, the purchase cost proportion may go up to 60 percent.

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Purchasing and Inventory Management

- While designing and developing an inventory control system, a series of activities, like placement of order, valuation of stock, controlling inventory of non-moving and slow moving items, taking effective steps to control overstock and understock occurrences, etc. need to be carried out as per the working of inventory control system as well as for performance monitoring and control.
- Purchasing procedure and norms influence significantly the performance and effectiveness of inventory management systems. Almost all inventory-related cost elements are affected by purchasing norms.

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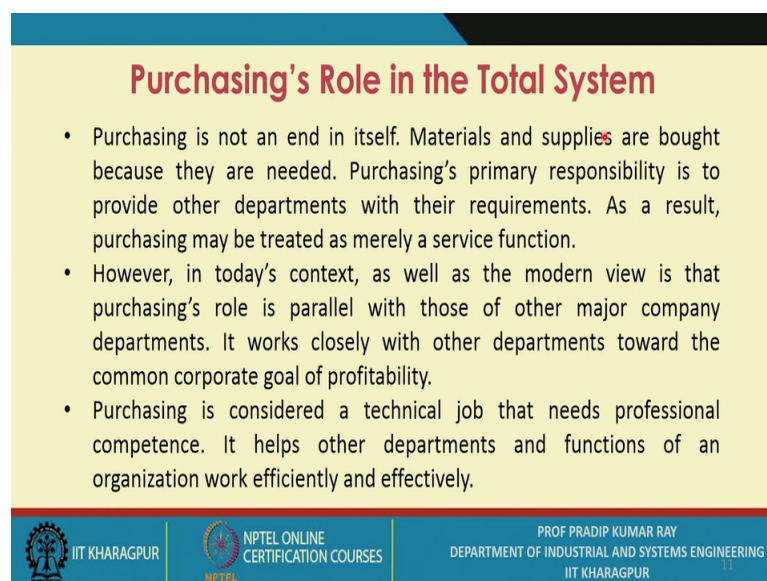
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So, these are the data you have and when you refer to this data, you conclude one thing that is given an industry of any type; you cannot ignore the importance of purchasing function. While designing and developing an inventory control system, a series of activities like placement of order valuation of stock; so this part also we will discuss you know this is when already we discussed, when we refer to say that the stores management, the valuation of stock.

Controlling inventory of non-moving and slow moving items, you refer to the classification of inventory items; taking effective steps to control over stock and under stock occurrences. These also another important activity need to be carried out as per the working of inventory control system as well as for performance monitoring and control. So, this point is made very clear. So, what we have found that why while you design an inventory control systems; so you need to carry out several sorts of activities and many such activities are directly or indirectly controlled by the purchasing department or the purchasing function.



So, the purchasing procedure and norms influenced significantly the performance and effectiveness of inventory management systems that is our conclusion and almost all inventory related cost elements, you are already aware of. We have dealt with the, this case several times in many lecture sessions. So, almost all inventory related cost elements are affected by purchasing norms.

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Purchasing's Role in the Total System

- Purchasing is not an end in itself. Materials and supplies are bought because they are needed. Purchasing's primary responsibility is to provide other departments with their requirements. As a result, purchasing may be treated as merely a service function.
- However, in today's context, as well as the modern view is that purchasing's role is parallel with those of other major company departments. It works closely with other departments toward the common corporate goal of profitability.
- Purchasing is considered a technical job that needs professional competence. It helps other departments and functions of an organization work efficiently and effectively.

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So, the key question is that what is the purchasing role in the total system? Looking at organization as the total system consisting of the several function several departments and these departments, these functions are interrelated. So, how do you explain the purchasing's role in the total system? So, let us go through certain you know say the points in this context. Purchasing is not an end in itself. That means, this is a means to achieve something else, to achieve you know maybe a condition in the production systems where the flow of material between the production stages or among the production stages is guaranteed.

And the second maybe you know the objective could be there; many objectives in fact. The second objectives could be that if you if you have a good or say effective purchasing system, now is it a helping you in achieving a condition of no over stock or no under stock. So, materials and supplies are bought because they are needed. If they are not needed it may, but they are they are purchased, sometimes this may happen. So, it will lead to the creation of deck stock. Already we have pointed out or at least the non moving items for the substantial time period.

Purchasing's primary responsibility is to provide other departments or functions with their requirements. That means, each a department or function like engineering department, like production department, or the like the finance department; they have their own requirements. So, whether to what extent the purchasing department is able to fulfill their requirements?

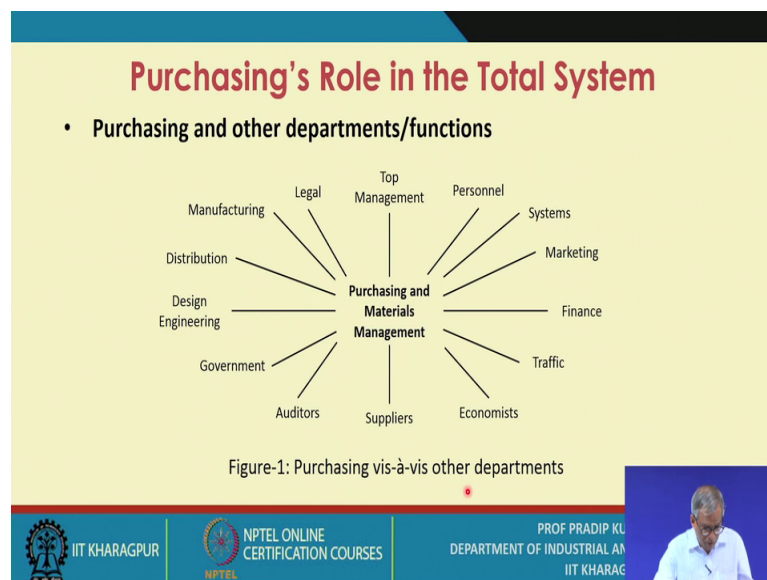
As a result purchasing may be treated as merely a service function. But today, what was happened and there are many changes already I have taken place. So, in today's context as well as the modern view is that the purchasing's role is parallel with those of other major component departments. That means, the purchasing department is not subordinate to other functions. So, it is at par at the same level with other functions of an organization. It works closely with other departments towards the common corporate goal of profitability.

And there are the many examples, that means, the company is performing excellently; the reason could be either the marketing department is performing excellently or the purchase department or the procurement functions in general the materials management

functions performance is excellent or you have both the functions performance as excellent level.

So, the purchasing is considered a technical job. Previously, it was not considered a technical job due to many reasons in fact. And, so this technical job needs professional competence. So, today, we will find that all in almost all the organizations, the purchasing department is headed by or is managed by the competent technical persons. It helps other departments and functions of an organizations work efficiently and effectively.

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Now, when you talk about the purchasing's say relationship with other departments and functions, you can have this figure, where you know this figure actually depicts the relationship between purchasing and other departments. So, purchasing is an important component in materials management and so it is refers to as the purchasing and materials management. So, it influences the efficiency and effectiveness of top management or the corporate level, the Personnel ok.

Then the systems performance, marketing performance, finance performance, traffic management, economist's performance. In fact, it is closely linked with the supply and you have an inbound logistics so the supply system. So, it is. So, the suppliers are influenced by the purchasing system. There are there are auditors. So, there they have their own role to play as far as you know the controlling of purchasing function is

concerned; obviously, you have to follow the rules and regulations as said by the Government or the state.

Now, when you talk about the product purchase obviously, you it is it is related to the many decisions you have to take and these decisions must be compatible with or say it must you know as per as per the requirements of the designer engineering department, then it is related to distribution function; sales and distributions and it is related to the manufacturing and it is also related to the legal sale of the company.

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Purchasing's Role in the Total System

Purchasing/Materials Interfaces: Important issues

- **Interfacing with production:** With change in production volumes and in types of components/parts/products, there is change in purchasing procedures and norms.
- **Interfacing with engineering:** For the items required to be procured, designed, and manufactured with acceptable specifications, reliability, and production costs, purchase of appropriate machine tools, cutting tools, holding devices becomes a critical task.

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Now, I just I would like to highlight some of the important issues when we talk about the interface interfacing, say the purchasing or the materials of management the department with other functions. Like when you talk about interfacing with production department, with change in production volumes and in types of components parts products, there is change in purchasing procedures and norms.

So, this is the point we understood. Interfacing with engineering, for the items required to be procured designed and manufactured with acceptable specifications, reliability, and production costs, purchase of appropriate machine tools, cutting tools, holding devices etcetera becomes a critical task. So, please note these important points as we have you know we have highlighted.

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Purchasing's Role in the Total System

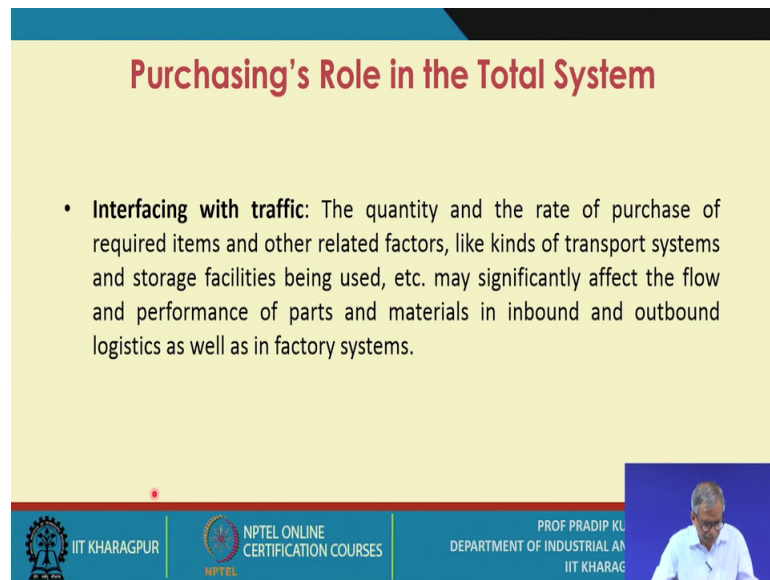
- **Interfacing with marketing:** Supply of bought-out components and materials to be used in the products effects significantly the ability of an organization to market both new and existing products.
- **Interfacing with stores:** Purchase of items in specified quantity and quality determines the types of storing facilities, including packaging, to be provided for keeping them in acceptable state for specified time period. This aspect may directly impact inventory carrying or holding cost.

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Interfacing with the marketing, supply of bought out components and materials to be used in the products effects significantly the ability of an organization to market both new and existing products. So, this point is to be noted. When you talk about interfacing with stores; so what are the critical points? Purchase of items in specified quantity and quality determines the types of storing facilities including packaging. Now this point is to be noted very carefully. To be provided for keeping them in acceptable state for specified time period. One of the important the role it plays that is how to keep the value of the product in acceptable condition.

So, if you so far, for keeping the value of the product in acceptable condition particularly during transit, you need to select the best possible the packaging materials as well as the packaging procedures you have to adopt. So, this aspect may directly impact inventory carrying or holding costs.

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Purchasing's Role in the Total System

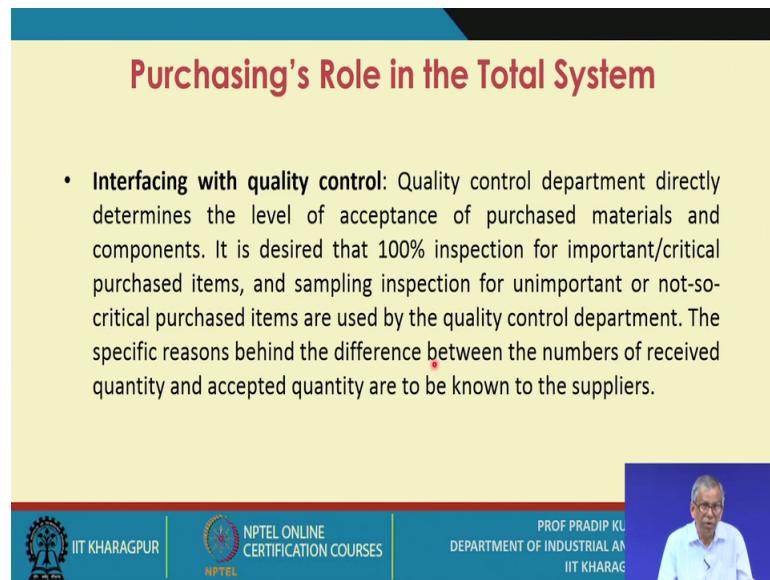
- **Interfacing with traffic:** The quantity and the rate of purchase of required items and other related factors, like kinds of transport systems and storage facilities being used, etc. may significantly affect the flow and performance of parts and materials in inbound and outbound logistics as well as in factory systems.

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Interfacing with traffic, the quantity and the rate of purchase of required items and other related factors, like kinds of transport systems and the storage facilities being used, may significantly affect the flow and performance of parts and materials in inbound and outbound logistics as well as in factory systems. So, there is a simple rule, if you find that there is a smooth flow of materials within the production system and all the machines majority of the machines are in running conditions at any point in time.

So, you conclude many things about the company or about the plant where it is happening this condition prevailing. Now, one such conclusion is your purchase department must be acting very efficiently and very effectively.

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Purchasing's Role in the Total System

- **Interfacing with quality control:** Quality control department directly determines the level of acceptance of purchased materials and components. It is desired that 100% inspection for important/critical purchased items, and sampling inspection for unimportant or not-so-critical purchased items are used by the quality control department. The specific reasons behind the difference between the numbers of received quantity and accepted quantity are to be known to the suppliers.

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When you talk about interfacing with quality control, now the quality control department directly determines the level of acceptance of purchased materials and components. It is desired that 100 percent inspection for important or critical purchased items, you have to follow and sampling inspection for unimportant or not so critical purchased items are to be used by the quality control department. So, this rule they follow. The specific reasons behind the difference between the numbers of received quantity and accepted quantity are to be known to the suppliers.

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Purchasing's Role in the Total System

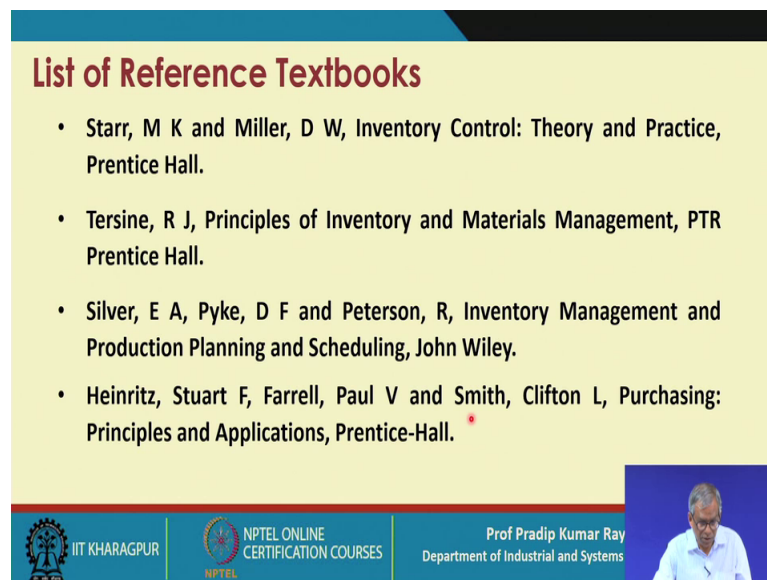
- **Interfacing with finance:** Financial performance is closely linked to the performance of purchasing function. The extent of values of 'cost of goods sold' as well as 'inventory' as shown in financial statements are dependent on purchasing function's policies and procedures is to be known by the management.
- You need to identify the factors affecting the relationship (as defined by the types of issues mentioned in interfaces), between purchasing and each of other functions/departments.

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So, this is one of the objectives. An Interfacing with the finance, the Financial performance is closely linked to the performance of purchasing function. This point already I have highlighted. The extent of values of 'cost of goods sold' as well as 'inventory' as shown in financial performance statements like in you know profit and loss statement or say balance sheet are dependent on purchasing functions policies and procedures to be known by the management.

So, you need to identify the factors affecting the relationship as defined by the types of issues mentioned in interfaces, already we have pointed out between purchasing and each of the other functions and the departments.

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List of Reference Textbooks

- Starr, M K and Miller, D W, Inventory Control: Theory and Practice, Prentice Hall.
- Tersine, R J, Principles of Inventory and Materials Management, PTR Prentice Hall.
- Silver, E A, Pyke, D F and Peterson, R, Inventory Management and Production Planning and Scheduling, John Wiley.
- Heinritz, Stuart F, Farrell, Paul V and Smith, Clifton L, Purchasing: Principles and Applications, Prentice-Hall.

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So, with this I conclude the lecture-1 session.

Thank you.