UNIT 20 MATERIALS INFORMATION SYSTEM

Objectives

After reading this unit, you would be able to :

- describe the information systems in materials management and explain their importance in manufacturing process;
- be familiar with the potential areas in materials management where the information system development enables us for quick decision;
- demonstrate the process of system development through examples; and
- highlight the features of Manufacturing Execution System(MES) in achieving Total Quality Management.

Structure

20.1 INTRODUCTION

Information can provide powerful tool for change. Information management is an important task to be handled carefully by the managers to keep themselves always connected to the latest developments for online decisions. Whether it is Finance, Marketing, Human Resource Management or Operations Management, all processes require a proper information system. An information center is a place where information is collected, transmitted, stored, analyzed, or compiled. The information relates to the internal operation of the firm as well as to the environment. Quite obviously, decision centers and information centers in the firm are inextricably bound together. Decision centers generally transmit decisions to others in the organization, and in a sense act as information centers. In simple terms, for an effective information management, the decision maker need to strictly systematize the procedure stated below:

a) gathering the facts in time,

b) Store them in an ordered way,

c) Process for the requirement and

d) Present them in a specified manner.

In manufacturing process, a group of people, machines & infrastructure work together by coordinating for producing different types of products with an objective of making optimum production and profitability. A set of transaction ties together the different activities manufacturing process. They are:

1) Request from customer to bid on special product

2) Orders for special products

3) Orders for standard products

4) Production orders

5) Move orders

6) Purchase orders

The entire process is carried out in an organized way. The systematic approach to execute the process involved in handling of materials for various purposes through predefined steps is called Materials management system. This can be done through programmed decisions so that the cost involvement in various processes of materials management like ordering for raw materials, utilization level of the stock, overstocking of the materials etc could be done judiciously.

In any manufacturing organization, it is required to deal with different forms, reports, memos, labels and cards in use to assess the status of items movement and stock available on hand. Many of these forms have the same usage with different layouts. Each one of them has to be filed manually. It is a very time consuming and laborious intensive process. Also, the transfer of these documents among related units of the production causes delays in decision-making. The Materials Information Management System streamlines and simplifies the entire filing procedure of the Bureau of Materials, thus relevant information is integrated into an electronic data processing and management system automatically. Materials Management uses bar code technology to maintain stock levels and to re-order stock-using hand held scanners.

20.2 ADVANTAGES OF MATERIALS INFORMATION SYSTEM

In addition to the above discussions, the materials Information management has certain advantages as stated below:

Reduces time and costs by

- Establishing direct link between the data capture system and the suppliers ordering system which reduces supply chain time and costs and reduces the ordering errors
- Simplifying ordering – the data is inputted direct to the supplier via a hand held barcode reader

The information retrieval through proper information system provides

- The data that can be used to forecast required stock
- Statistical analysis of historical data and generate reports to review product use and to identify better efficiencies

It gives flexibility to manage products by

- Helping with product standardization programmes and effective stock control, leading to more efficient use of limited storage and effective stock control
- Providing a modular storage system
- Streamlining receipting procedures, leading to improved payment systems

It saves money

- By saving on requisition costs, reducing obsolescence and waste and simplifying stock valuation for the company

- By helping to give a clear understanding of a company's spend and operating costs
- By providing realistic stock levels linked to actual usage- matching service delivery with company actual service need

Processing of a customer needs from its identification through conversion of raw materials into finished goods and the distribution of these goods is carried out by a sequence of fairly distinct activities. These activities are called the technical development of the system. Out of all other system in functional management, the sub-system used for materials manufacturing is considered to be significant in operations management. They are inventory control system, demand management system, remote electronic requisition system, warehouse management system, waste management system etc. These sub-systems operate based on the product specification, schedule, demand, availability of raw materials and assemblers.

A system to control movement and storage of materials within a warehouse is called Warehouse Management System. The role of Warehouse Management System is expanding to including light manufacturing, transportation management, order management, and complete accounting systems.

The general function of materials information system integrates the various other subsystems as shown below:

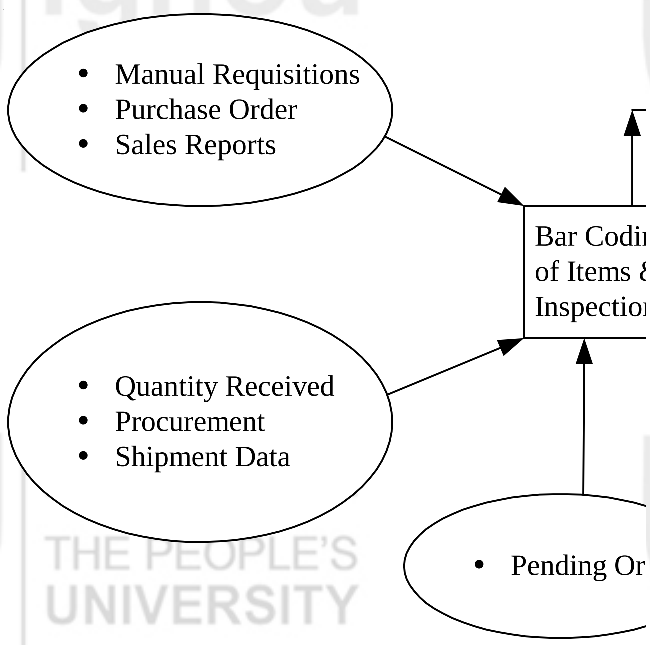

Figure 20.1: Material

The design and the development of the materials information system require considerable research efforts. The major study topics include:

1) Identify and synthesize the operational logic and business rules in the materials testing processes to search for the best ways to organize and unify the forms, reports, approvals and all relevant documents. Use of bar code technology for locating the status of the products.
2) Identify and normalize the relational database to secure data integrity and manage data flows within existing networks using bar codes assigned to the product
3) To convert and integrate the existing electronic data for concrete decisions through proper statistical analysis

4) To protect and archive the data and outputs

5) To improve the system flexibility such that new materials and new information can be inserted

6) To minimize the data entry errors through cross checking

7) To minimize the routine workload and improve the efficiency of the data processing with customized client application programs and

8) To automate the filing processes and speed-up the closeout procedures by scheduled replication tasks and alert message service of the database. In other words, the entire closeout procedure will be monitored by the system and the responsible person will be notified of the current project status.

20.3 FUNCTIONS OF MATERIALS INFORMATION SYSTEM

The two main functions of Materials Information system are to generate an unordered requirements listing for input to the purchasing system and to provide a materials status and history report for use as follow up and status information. This would facilitate to:

i) Identify and order long lead-time items in the early stages of requirements determination

ii) Reduce existing clerical work load by paper work automation to the extent practicable

iii) Provide a system of quick, accurate follow up and status reporting

iv) Provide whatever controls are needed to ensure that all required items are ordered and not duplicated

v) Sketch the movement of items and report the status for further planning.

As can be seen, this system mainly deals with two different areas of operations management namely Inventory Control, and Production & Manufacturing. Let us try to understand the development of systems taking into all the aspects of requirement and output for such system.

The inventory management system deals with:

- Maintaining an optimum level of raw materials and finished goods inventory
- Consolidation of purchase orders and inventory status
- Preparation of analysis reports like lead time, number of optimum runs etc
- Generation of MIS reports required for decision making

The various inputs and the processing of data to get output to this system are as follows:

Table 20.1 : Inputs and Outputs for an inventory management system

System objectives	Inputs receivable	Processing tools	Output formats	Decisions
Maintaining optimum level of raw materials and other finished goods	Data of suppliers vendors, and buyers, storage cost	Models used in Operations research for EOQ	Number of units to be ordered in a specific interval	Minimize the inventory cost

Consolidation of purchase orders and inventory status	Materials requisition slips, Delivery challans, materials return status	Tools of classification and tabulation and simple analysis, OR techniques	Demand quantity and order quantity	Forecast for future trend
Preparation of various analysis reports	Goods received, quantity issued, materials jejection	Different parameters like lead time, percentage of rejection, capacity production	Number in units specified	Optimum quantity order
MIS report	Using existing master data based on all receipts and issues	Operations and queuing tools	Decision reports online information	Effective and timely decisions

Process of production and manufacturing deals with the following objectives:

- Compute parts from production schedule which include the economic number of outputs per unit
- Minimize the production schedule
- Reduce clerical costs
- Control backorders

The system requirement, tools utilized and the output expected to this system are as follows:

Table 20.2 : Inputs and Outputs for a production and manufacturing system

System objectives	Inputs receivable	Processing tools	Output formats	Decisions
Calculate the optimum number of units per production run	Bills of materials, production schedule, time requirement	Production models	Quantity of output and expected time	Materials requirement and supply in time
Optimize production schedule	Market data and requirement movement	Trend analysis, scheduling tools	Number of optimum production runs required	Minimize production cost
Reduce clerical costs	Quantum of invoices and processing bills handled	Manpower planning	Requirement of manpower	Reduce manpower cost
Control back-orders	Demand notes and lead time	Operations research tools	Exact requirement and expected demand	Reduce shortage costs

The schematic representation of the materials process, in general for both the operations, can be seen from the following figure.

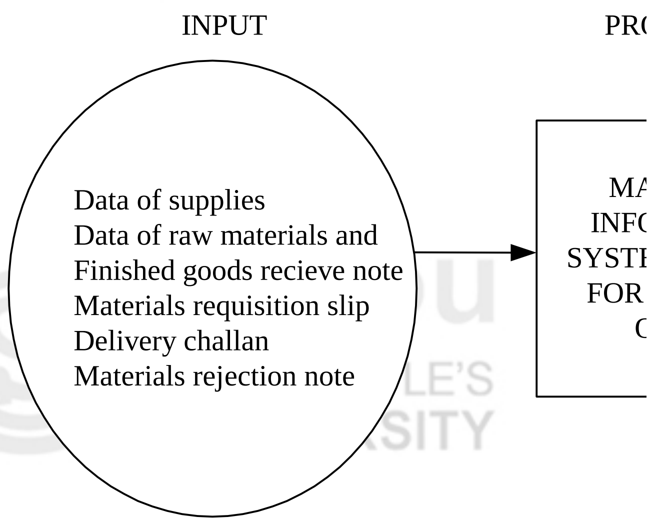

Figure 20.2: Input, Process and Outpu

20.4 SYSTEM APPROACH TO MATERIALS MANAGEMENT: CLASSICAL MODEL

In industrial situations decision-making is a continuous process. It is a conversion mechanism for changing continuously varying flows of information into control signals that determine rates of flows in the system. For example, various parameters used in industrial decisions like economic order quantity, lead-time, expected waiting time are not static. Decision point is continuously yielding to the pressures of environment. It is taking advantage of new developments as they occur. It is always adjusting to the state of affairs. It is treading a narrow path between too much action and too little. It is always attempting to adjust towards the desired goals. The amount of action is some function of the discrepancy between goals and observed system status.

Let us take an example of very frequently used illustration in materials production pertaining to inventory models. The status of inventory is linked with the production, distributors and retailers. A demand function has been specified in order to generate the orders from the ultimate customers. At each level of factory, distributor and retailer, an inventory of stock item is held and periodically replenished. Delays in processing orders are assumed, as well as the delays in transmission of orders between levels. Materials flow is delayed between the levels to represent time required for shipment. Hence the database once created can be used as centralized pool of information and can be retrieved in whatever the format required.

Consider another example of retailer's distribution system as discussed by McMillon and Gonzalez. Requisitions arrive from customers and go into an unfilled order file. Shipments from the distributor arrive and enter inventory. From this inventory deliveries are made to fill customer's requisitions. Decisions concerning shipments to customers and quantities to order to replenish the inventory are made at a decision centre on the basis of knowledge of (or information form) unfilled orders, actual inventory, and desired inventory.

Three kinds of flow can be traced in the system: materials flow, information flow, and order flow.

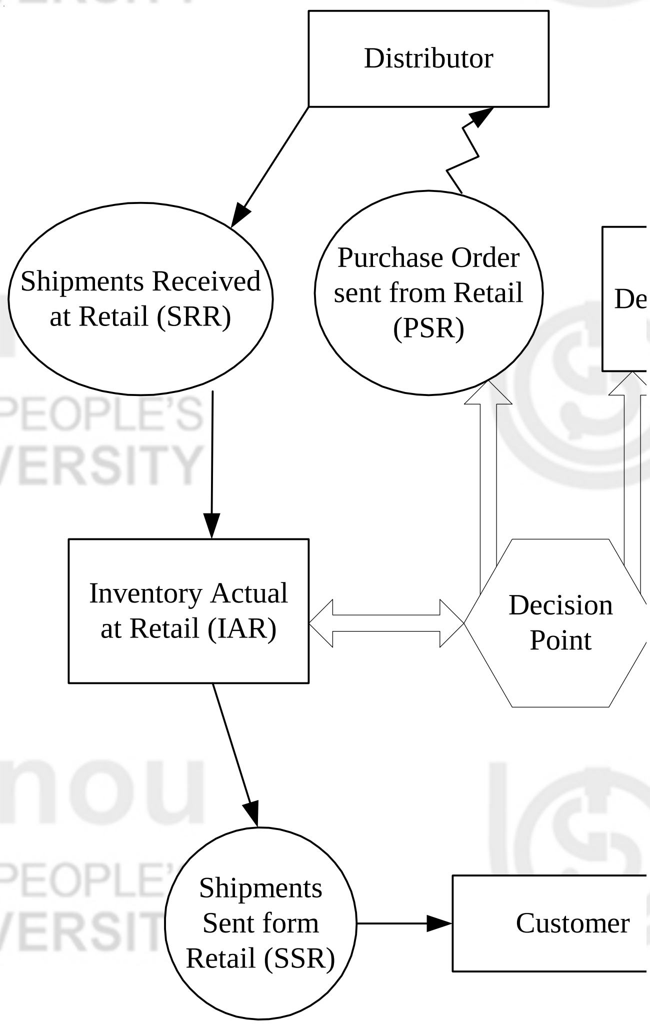

Figure 20.3: Three Kinds

Inter-relationship among different states of retailer's distribution system

The inter-relationship among the different state of the system can be expressed by the following equation.

$RRR_n = f(n)$

$SSR_n = RRR_{n-2}$

$SSR_n = PSR_{n-3}$

$UOR_n = UOR_{n-1} + RRR_n - SSR_n$

$IAR_n = IAR_{n-1} + SRR_n - SSR_n$

$IDR_n = 20/9 \, [RR_n + RRR_{n-1} + RRR_{n-2}]$

$PSR_n = RRR_n + ½ \, [IDR_{n -} \; IAR_n]$

$$\begin{pmatrix} RRR_n \\ SSR_n \\ SRR_n \\ UOR_n \\ IAR_n \\ IDR_n \\ PSR_n \end{pmatrix}$$

In which RRR $_n$ is the exciter of the system is a function of time, n. The state vector is the state of the system at any period in time 'n' is simply the value of the variables in this vector in period 'n'

It is clear from the above illustration that most of the parameters in materials movements are inter-related and recursive in nature. Analytical decisions through systematic calculation enable the decision maker to know or predict the required decision points. Sometimes even the graphical analysis using the existing functional equations help the analyst to present proper results through graphs. The information system designed in this situation will be able to help for drawing proper interpretation.

20.5 SIMULATION METHODS FOR MATERIALS INFORMATION: A SYSTEM APPROACH

In developing simulation models one is continuously tempted to abandon specific cases and to pursue the exclusive but intriguing universal model, the general systems simulator or as are ultimate, the general problem solver.

From a theoretical point of view, the universal model is potentially a powerful analytical construct by means of which we can immensely improve our understanding of the decision making process. But in dealing with applied problems in business and industry are must concern ourselves with the specific. Now let us understand the importance of information management in an industrial situation to control the production level to optimize the profit.

SYSCO manufacturing company assembles computers for domestic use. SYSCO has these units custom-made by a variety of suppliers and it resells them under the brand name SYSCOM.

Lead-time for delivery of new stock from their suppliers, SYSCO has found, Varies in a random fashion, with the following distribution.

Lead time	Probability
4	.10
5	.15
6	.50
7	.15
8	.10

While SYSCO is uncertain about demand from week to week (and uses a sales forecasting strategy that will be described shortly), demand is in fact, normally distributed about a mean of 50 SYSCOMS per week with a standard deviation of 15.

When customers request SYSCOMS and SYSCO is unable to deliver immediately due to stock-outs, customer orders are back ordered, and customer back orders are first satisfied out of new stock received. New stock is received over the weekend.

At the end of each week SYSCO management appraises its operating experience during the week, updates records, and makes two decisions:

i) Whether to declare a price markdown if demand has been less than that demand satisfactory and

ii) How many new machines to produce, if any.

Method of simulation based on probable demand from previous data is the best tool to apply. Simulation either in the form of hand simulation or mechanical method is quite obvious and required repetitive calculations. The problem is to develop an information system by which SYSCO's operating experience can be simulated so that certain policy decision (notably the demand and forecasting strategy and the inventory management policy) can be tested to determine their influence on profits, and so on. It would be profitable to design appropriate computer programs through subroutines for generating demand and determining limits and making policy decision.

20.6 INFORMATION SYSTEM FOR TOTAL QUALITY MANAGEMENT (TQM)

Total quality management as stated by Arora and Bhatia, is a philosophy aimed at each and every aspect of business activity in alignment to the customer perspective. The objective of TQM is achieving the concept of JIT (Just In Time) with initial applications in the area of inventory management focusing on delivery schedules. Purchase of materials and components arrive just in time in the factory site, often in few hours when requisitioned. This requires placing small and frequent orders and restructuring relationship with suppliers. The concept has further normalized to produce as needed to meet customers order resulting in reducing lead times. The aim is delineated to include elimination of inefficiency and improvement of product quality in the manufacturing process. TQM has found relevance particularly in manufacturing process which is by CIM (Computer Integrated Manufacturing) including Computer Aided Design, product data management and manufacturing execution system. Management of Information System plays a very vital role in providing the required inputs at various stages to maintain the integrity of the system.

20.6.1 Manufacturing Execution System (MES)

The MES includes shop floor control, operator guidance and quality system. A cross-functional team approach is encouraged for optimum employee participation. MES is being considered as a key technology in drive to improve manufacturing performance capability in the fiercely competitive global marketplace. MES is being increasingly applied in a number of discrete batch and continuous process manufacturing industries such as semiconductors, pharmaceuticals, petrochemicals, plastics and medical equipments. Integrated MES implementation through computerized systems provide useful integration of real time data with other information systems such as production planning system and distribution control system. The corporate major objectives such as profitability, market share and improved global competitiveness can be realized through specific improvements such as short production runs, improved quality, lower costs and customer responsiveness with the implementation of integrated computerized MES. Schedule adherence, routing management, operator certification control, work in progress management, process control, real time statistical process control and statistical product monitoring are important ingredients of MES system aimed at improved product quality and customer responsiveness.

20.7 SUMMARY

Development of Information system plays an information role in managerial decision-making. Various manual formats are being needed to reference the information from the master file, proper approach enables accurate information.

In this unit you have been exposed to the importance of Information System in Materials Management with illustrative examples giving the steps for development of a system. As the management of materials in a typical manufacturing environment