

## Chapter 2

### Literature Survey

#### 2.1 Concerned Theory

➤ Norma Michael, Celia Burton, **Basis Project Management** (1993)

The definition of project management is the process by which the project manager plans and controls the task within the projects and the resources on which the organization draws to carry out the projects. By *resources* we mean :

- People
- Money
- Equipment
- Time

Project management is a skillful use of techniques to achieve the required results to a set standard, within a budget and within a certain time.

➤ Harold Kerzner, **Project Management for Executives** (1982)

Project management is designed to manage or control company resources on a given activity, within time, within cost, and within performance. Most companies have resources :

- Money
- Manpower
- Equipment
- Facilities
- Materials
- Information / Technology
- Time (Schedule)

The responsibilities of the project manager and project engineer is as shown below :

**PROJECT MANAGEMENT**

- Total project planning
- Cost control
- Schedule control
- System specifications
- Logistic support

**PROJECT ENGINEERING**

- Total project planning
- Cost control
- Schedule control
- System specifications
- Logistic support

- Contract control
- Report preparation and distribution
- Procurement
- Identification of reliability and maintainability requirements
- Staffing
- Priority scheduling
- Management information system
- Configuration control
- Technical leadership support for fabrication, testing and production

➤ Donald W. Fogarty, **Production & Inventory Management** (1991)

Successful project completion requires timely monitoring of work completion and comparison to scheduled completion. Control of project is based on the some principles below :

1. Plans should be realistic and not reflect an overstated estimate of capacity.
2. Control of the planning activity itself requires :
  - a. Management commitment to the objectives of the plan and the availability of the resources
  - b. Agreement (preferably in writing) by the appropriate managers and supervisors that the precedence relationships, time estimates, and costs are realistic.
3. A performance reporting system with adequate, accurate, and timely information should exists. More project completion situations are dynamic. Changing conditions and actual performance initiation and completion may change priorities.
4. Procedures should exist for evaluating performance on a regular basis, for determining what, if any, corrective action is required, and for revising schedules and operating plans accordingly.

Inventory management of individual items encompasses the principles, concepts, and techniques for deciding what to order, how much to order, when it is needed, when to order for purchase or production, and how and where to store it. Decisions at each of these levels should be consistent with decisions at the other levels (integrated) and should support organizational objectives by (1) defining and attaining desired levels of customer service and (2) achieving inventory investment objectives.

Successful inventory management requires adequate administrative, physical, and financial controls. These controls are achieved by inventory records and record-keeping practices, auditing practice, inventory evaluation methods, and storekeeping and security.

➤ Barry Render, **Principles of Operations Management** (1994)

The purpose of materials management is to obtain efficiency of operations through the integration of all material acquisition, movement, and storage activities in the firm.

➤ Dean S. Ammer, **Materials Management and Purchasing** (1980)

Project control problems involving material, labour and equipment are inevitably interrelated. The basic project control system is to bring all three resources together at the right time in the proper quantities.

➤ Eugene L. Magad, **Total Materials Management** (1995)

Materials management can be defined as an organizational concept that fosters a total systems approach to plan, acquire, store, move, and control materials in order to optimize all company resources and provide customer service consistent with company policy.

### ***Inventory Control***

Inventory control includes activities and techniques required to maintain materials at desired levels. Major activities includes :

1. Determining how much material will be required to satisfy company operational demands.
2. Maintaining detailed records of all materials available, ordered, and consumed.
3. Determining optimum order quantities; issuing requisitions.
4. Providing appropriate reports to and in decision making with regard to inventories.

### ***Receiving and Stores***

Receiving and stores is responsible for activities related to receiving, storing, handling, issuing, and controlling materials. Major activities include :

1. Receiving materials which includes verification that the order was made and that the quantity received is correct, and preparation of a receiving report.
2. Storing receiving and inspected materials in accordance with efficient operating procedures that optimize use of space, equipment, personnel, and control of locations.
3. Issuing materials with authorized requisitions and accepting returned materials.
4. Maintaining control of physical counts to assure materials availability and performing periodic and annual physical inventories.

### ***Material Handling***

Materials handling involves both design and physical movement. It is the function of developing and implementing appropriate manual, mechanized, and automated systems to provide movement of materials throughout the company. Major activities include :

1. Analyzing company operations to determine the need for improved materials handling.
2. Designing and justifying new materials handling systems that will provide increased production capacity, improved materials flow, reduced costs, improved working conditions, and reduced waste.
3. Providing user-oriented materials handling systems.
4. Transporting materials to and from storage areas and the point where they will be used.

➤ Harold T. Amrine, **Manufacturing Organization and Management** (1993)

Recently, the material handling function has been undergoing significant changes in concept and implementation. Management has been changing its view of materials handling as the routine transfer of materials from place to place and is beginning to think of it as part of a *total material flow system*. This change in thinking has come about largely as result of new automatic handling and storage equipment and systems that are integrated closely with automatic processing and sophisticated management information and control systems. Through the installation of such systems, companies are recognizing that they may benefit from economics in production and distribution, space savings, improved shop control, decreased parts shortages, fewer late deliveries, and improved quality. It is not surprising, then, that materials handling is one of the principal areas in which industry's equipment investment is markedly on the increase.

***Objectives of Inventory Management and Control***

The ultimate objective of all manufacturing control is to realize a profit through the operation of the business. A more restricted objective of the control of material is to satisfy the customer by meeting the schedule for deliveries. Failure to deliver orders on time is one principal cause of loss of business and customers. Effective control of the material throughout the manufacturing cycle reduces the chance of this problem arising.

Specific objectives of the inventory management and control group are to maintain optimum inventory levels and inventory turnover for operation of the business at maximum profit and, through the control of inventories, to ensure that the right material, in the right quantity, and of the right quality, is made available at the right place at the right time.

***Inventory Management***

The planning of the control of inventory can be divided into two phases, *inventory management and inventory control*. Inventory management accomplishes the first phase, consisting of :

1. Determination of optimum inventory levels and procedure for their review and adjustment
2. Determination of the degree of control that is required for the best results
3. Planning and design of the inventory control system
4. Planning of the inventory control organization

### ***Inventory Control***

The inventory control group puts the plans of inventory management into operation. These plans are seldom complete in every detail. The day-to-day planning required to meet production requirements-the second phase of planning for inventory control-is the responsibility of this group.

Another responsibility is the recording and reporting of transactions involving movement of material and of the effect on the different inventories.

The basic information normally carried on perpetual inventory records includes :

- On order* This part of the record shows the quantity of material ordered but not received. New orders are added and receipts subtracted.
- Received* All receipts are posted here.
- On hand* This balance figure represents the quantity of the item that should be in the stock room. Receipts are added and issues subtracted.
- Issued* A record of all quantities issued to the factory (installation) is entered.
- Allocated* This is the quantity to be reserved for later issue for specific orders. Reserving of materials still in the stock room will ensure their availability when they are needed on the manufacturing floor
- Available* This is the quantity of material on hand that is still available for assignment to future orders

➤ J.R. Tony Arnold, **Introduction to Materials Management** (1996)

Materials management is a coordinating function responsible for planning and controlling materials flow. Its objectives are as follows :

- Maximize the use of the firm (site) resource
- Provide the required level of customer service (project work)

Materials management is a balancing act. The objective is to be able to deliver what customer want, when and where they want it, and do so at minimum cost. To achieve this objective, materials management must make tradeoffs between the level of customer service and the cost of providing that service. As a rule, costs rise as the service level increases, and materials management must find that combination of inputs to maximize service and minimize cost.

### *Purchasing Cycle*

The purchasing cycle consists of the following steps :

1. Receiving and analyzing purchase requisitions.
2. Selecting suppliers. Finding potential suppliers, issuing requests for quotations, receiving and analyzing quotations, and selecting the right supplier.
3. Determining the right price.
4. Issuing purchase orders.
5. Following-up to assure delivery dates are met.
6. Receiving and accepting goods.
7. Approving supplier's invoice for payment.

### *Receiving and analyzing purchase requisition*

Purchase requisitions start with the department or person who will be the ultimate user. In the material requirements planning environment, the planner releases a planned order authorizing the purchasing department to go ahead and process a purchase order. At a minimum, the purchase requisition contains the following information :

- Identity of originator, signed approval, and account to which cost is assigned.
- Material specification.
- Quantity and unit of measure.
- Required delivery date and place.
- Any other supplemental information needed.

### *Selecting suppliers*

Identifying and selecting suppliers are important responsibilities of the purchasing department. For routine items or those that have not been purchased before, a list of approved suppliers is kept. If the item has not been purchased before or there is no acceptable supplier on file, a search must be made. If the order is of small value or for standard items, a supplier can probably be found in a catalogue, trade journal, or directory.

### *Requesting quotations*

For major items, it is usually desirable to issue a request for quotation. This is a written inquiry that is sent to enough suppliers to be sure competitive and reliable quotations are received. *It is not a sales order.* After the suppliers have completed and returned the quotations to the buyer, the quotations are analyzed for price, compliance to specifications can be accurately written, the choice is probably made on price, delivery, and terms of sale. For items where specifications cannot be accurately written, the items quoted will vary. The quotations must be evaluated for technical suitability. The final choice is a compromise between technical factors and price. Usually both the issuing and purchasing departments are involved in the decision.

### *Determining the right price*

This is the responsibility of the purchasing department and is closely tied to the selection of suppliers. The purchasing department is also responsible for price negotiation and will try to obtain the best price from the supplier.

### *Issuing a purchase order*

A purchase order is a legal offer to purchase. Once accepted by the supplier, it becomes a legal contract for delivery of the goods according to the terms and conditions specified in the purchase agreement. The purchase order is prepared from the purchase requisition or the quotations and from any other additional information needed. A copy is sent to the supplier; copies are retained by purchasing and are also sent to other departments such as accounting, the originating department, and receiving.

### *Following-up and delivery*

The supplier is responsible for delivering the items ordered on time. The purchasing department is responsible for ensuring that suppliers do deliver on time. If there is doubt that delivery dates can be met, purchasing must find out in time to take corrective action. This



might involve expediting transportation, alternate sources of supply, working with the supplier to solve its problems, or rescheduling production.

The purchasing department is also responsible for working with the supplier on any changes in delivery requirements. Demand for items changes with time, and it may be necessary to expedite certain items or push delivery back on some others. The buyer must keep the supplier informed of the true requirements so that the supplier is able to provide what is wanted and when.

#### *Receiving and accepting goods*

When the goods are received, the receiving department inspects the goods to be sure the correct ones have been sent, are in the right quantity, and have not been damaged in transit. Using their copy of the purchase order and the bill of lading supplied by the carrier, the receiving department then accepts the goods and writes up a receiving report, noting any variance. If further inspection is required, such as by quality control, the goods are sent to quality control or held there for inspection. If the goods are received damaged, the receiving department will advise the purchasing department and hold the goods for further action. Provided the goods are in order and require no further inspection, they will be sent to the originating department or to inventory.

A copy of the receiving report is then sent to the purchasing department noting any variance or discrepancy from the purchase order. If the order is considered complete, the receiving department closes out its copy of the purchase order and advises the purchasing department. If it is not, the purchase order is held open awaiting completion. If the goods have also been inspected by the quality control department, they, too, will advise the purchasing department whether the goods have been accepted or not.

#### *Approving supplier's invoice for payment*

When the supplier's invoice is received, there are three pieces of information that should agree: the purchase order, the receiving report, and the invoice. The items and the quantities should be the same on all; the prices, and extensions to prices, should be the same on the purchase order and the invoice. All discounts and terms of the original purchase order must be checked against the invoice. It is the job of the purchasing department to verify these and to resolve any differences. Once approved, the invoice is sent to accounts payable for payment.

### ***Warehouse Activities***

Operating a warehouse involves several processing activities, and the efficient operation of the warehouse depends upon how well these are performed. These activities are as follows :

1. *Receive goods.* The warehouse accepts goods from outside transportation or an attached factory and accepts responsibility for them. This means the warehouse must :
  - a. Check the goods against an order and the bill of lading
  - b. Check the quantities
  - c. Check for damage and fill out damage reports if necessary
  - d. Inspect goods if required
2. *Identify the goods.* Items are identified with the appropriate stock-keeping unit (SKU), number and the quantity received recorded.
3. *Dispatch goods to storage.* Goods are sorted and put away.
4. *Hold goods.* Goods are kept in storage and under proper protection until needed.
5. *Pick goods.* Items required from stock must be selected from storage and brought to a marshaling area.
6. *Marshal the shipment.* Goods making up a single order are brought together and checked for omissions or errors. Order records are updated.
7. *Dispatch the shipment.* Orders are packaged, shipping documents prepared, and goods loaded on the right vehicle.
8. *Operate an information system.* A record must be maintained for each item in stock showing the quantity on hand, quantity received, quantity issued, and location in the warehouse. The system can be very simple, depending on a minimum of written information and human memory, or it may be a sophisticated computer-based system.

### ***A simple, well-documented transaction system***

When goods are received, issued, or moved in any way, a transaction occurs. There are four steps in any transaction : identify the item, verify the item, verify the quantity, record the transaction, and physically execute the transaction.

#### 1. Identify the item

Many errors occur because of incorrect identification. When receiving an item, the purchase order, and quantity must be properly identified. When goods are stored, the location must be accurately specified. When issued, the quantity, location, and material number must be recorded.

## 2. Verify quantity

Quantity is verified by a physical count of the item by weighing or measuring.

## 3. Record the transaction

Before any transaction is physically carried out, all information about the transaction must be recorded.

## 4. Physically execute the transaction

Move the goods in or out of the storage area.

### ***Stock Location***

Stock location, or warehouse layout, is concerned with the location of individual items in the warehouse. There is no single universal stock location system suitable for all occasions, but there are a number of basic systems that can be used. Which system, or mix of systems, is used depends on the type of goods stored, the type of storage facilities needed, the throughput, and the size of orders. Whatever the system, management must maintain enough inventory of safety and working stock to provide the required level of customer service, keep track of items so they can be found easily, and reduce the total effort required to receive goods, store them, and retrieve them for shipment.

The following are some basic systems of locating stock :

#### *Group functionally related items together*

Group together items similar in their use (functionally related). For example, put all hardware items in the same area of the warehouse. If functionally related items are ordered together, order picking is easier. Warehouse personnel become familiar with the locations of items.

#### *Group fast-moving items together*

If fast-moving items are placed close to the receiving and shipping area, the work of moving them in and out of storage is reduced. Slower moving items can be placed in more remote areas of the warehouse.

#### *Group physically similar items together*

Physically similar items often require their own particular storage facilities and handling equipment. Small packaged items may require shelving whereas heavy items, such as drums, require different facilities and handling equipment.

*Locate working stock and reserve stock separately*

Relatively small quantities of working stock-stock from which withdrawals are made-can be located close to the marshaling and shipping area whereas reserve stock used to replenish the working stock can be located more remotely. This allows order picking to occur in a compact area and replenishment of the working stock in bulk by pallet or container load.

There are two basic systems for assigning specific locations to individual stock items : *fixed location and floating location*. Either system may be used with any of the above location systems.

*Fixed location*

In this system a stock keeping unit is assigned a permanent location, and no other items are stored there. This system makes it possible to store and retrieve items with a minimum of record keeping. However, fixed-location system usually have poor cube utilization. If demand is uniform, presumably the average inventory is half the order quantity, and enough space has to be allocated for a full-order quantity. On the average, only 50% of the cube space is utilize. Fixed-location systems are often used in small warehouses where space is not at a premium, where throughput is small, and where there are a few stock keeping units.

*Floating location*

In this system, goods are stored wherever there is appropriate space for them. The same stock keeping unit may be stored in several locations at the same time and different locations at different times. The advantage to this system is improved cube utilization. However, it requires accurate and up-to-date information on item location and the availability of empty storage space so items can be put away and retrieved efficiently. Modern warehouses using floating-location system are usually computer based. The computer assigns free locations to incoming items, remembers what items are on hand and where they are located, and directs the order picker to the right location to find the item. Thus, cube utilization and warehouse efficiency are greatly improved.

➤ Spencer B. Smith, **Computer-Based Production and Inventory Control** (1989)

***Warehousing Functions***

The principal functions performed by a warehouse are as follow :

- |                      |  |
|----------------------|--|
| Receiving -          | Material is accepted from manufacturing, from vendors, or from customers (returns). This is matched against receiving papers, counted, and, possibly, inspected for quality. Items may be marked or tagged to facilitate later identification. |
| Put away -           | Items are sorted by storage area, transported to those areas, and put away in racks or other storage equipment.  |
| Storage -            | Items are held and protected in storage until they are needed.   |
| Order picking -      | Items listed on orders received from manufacturing or customers are withdrawn from their storage locations.  |
| Marshaling -         | The items constituting an order are assembled and checked. Where several orders are to be transported together on one truck or rail car, these orders are grouped.   |
| Physical inventory - | Items held in storage must be counted to verify the accuracy of the inventory records. This may be done periodically, such as annually, or continuously, called cycle counting.  |
| Reporting -          | All receipts, issues, and adjustments due to physical inventories must be reported so that the inventory records are kept current.   |

*The system data base*

The heart of a computer-based inventory control system is its data base. In implementing computer-based systems, developing the data base may be the most challenging and time-consuming part of the job. And once the system is in operation, it becomes an important and substantial ongoing task to assure that the data are continuously up to date and accurate.

The record contains four categories of information : identification and description, planning information such as what order quantity calculation to use, inventory records, and cost data for use in accounting.

➤ Frank Osborn, **Costing and Control for Materials** (1980)

***Material Movement and Storage***

*Key objectives in the Movement Cycle*

These objectives are timeliness, economy in movement, and limitations in the volume which is inactive at any time.

*Services provided by Storage*

The complete range of services need not be available in any one storage situation, but they should cover the following functions :

1. Acting as a buffer or an insurance against the consequences of non-availability.
2. Acting as a link between bulk purchases and the breaking down into units of need.
3. Providing security.
4. Preventing damage or deterioration.
5. Providing a means of ensuring a control on usage, through a discipline of authority for withdrawals, formalized rationing of issues, recording of data for control, etc.
6. Serving as a checking function on work done.
7. Serving as a means of minimizing cost in movement and total effort through systematic location, economy of handling etc.
8. Forming a basis for good housekeeping, discipline and hence control. Storage brings a sense of tidiness and good order and helps to emphasize the importance of responsibility and accountability.

***Materials Classification and Coding***

Some reasons for coding and classification

1. The growing multiplicity of inventories and therefore descriptions.
2. Technical differences or properties not readily apparent in similar items.
3. The wide range of descriptions for the same article.
4. The length of descriptions required to interpret the necessary characteristics. Cost factors are here concerned :  
the time required to reproduce the descriptions in full, bearing in mind numbers and occasions,  
the space needed on documents, and also dangers of misinterpretation from

the tendency to abbreviate, and

the use of nicknames

5. Letters and words are not ideally suited to computer recording. Symbols, particularly numerical, are more acceptable.

The general objectives in a system of coding are to obtain :

1. The easiest and safest recognition and therefore translation.
2. Avoidance of ambiguity.
3. Saving of costs in transcription.
4. Elasticity in catering for expansion of the range and amendments.