

Management of Machines and Materials

By: Manisha Chattopadhyay

This reference book can be useful for
BBA, MBA, B.Com, BMS, M.Com, BCA, MCA
and many more courses for Various Universities



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Sample Preview of The Chapter

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MANAGEMENT OF MACHINES AND MATERIALS

OPERATIONS MANAGEMENT: AN OVERVIEW

Operations Management: An Overview

1

INTRODUCTION

All organisations earn their revenue by offering products and/or services for sale. The products, and/or services, that are offered for sale is the output of the organisations. For making the output an organisation requires certain inputs or raw materials and a conversion process to transform the input into the output. The management of the conversion process, which can include transformation, transportation, storing and inspection of inputs, is called operations management. Earlier the subject was called Productions Management. The name was later changed to Operations Management to encompass the study of management of conversion process in the rapidly growing services sector.

CHAPTER AT A GLANCE

SYSTEMS CONCEPTS IN OPERATIONS MANAGEMENT

A system is a collection of objects which are interrelated and interdependent. A system within a bigger system is called a sub-system. A system draws inputs from the environment and converts them into outputs which are again let out in the environment. An organisation can also be viewed as a system as it takes input from the environment in the form of raw materials, labour and capital and converts them into finished products to be sold to consumers. The output of one organisation forms the input of another organisation or household and that is the way a particular organisation

is linked with other organisations or households in its environment. Hence, if we take a larger view, an organisation's environment is the system and the organisation is a sub-system. If we take a micro view, the departments within an organisation namely—finance, marketing, MIS, materials, HRD and operations can be all viewed as subsystems of the organisation system. The operations system draws inputs from other departments to convert them into outputs which when converted to money through sales, serves as inputs for all other departments. Inputs can be tangible such as labour or capital or intangible such as information or knowledge. A subsystem influences as well as is influenced by the activities of other subsystems and often functions of subsystems may overlap.

OBJECTIVES IN OPERATIONS MANAGEMENT

The objectives of the operations management systems flow from the corporate objectives and strategies. If the organisation adopts a low cost strategy then the operations department will have to aim for achieving a given output with minimum input. On the other hand if the organisation aims for a differentiation strategy then operations system should aim for flexibility. Whatever the corporate strategy, increasing the productivity, that is the output to input ratio, is always the concern of the operations department. Usually the output is fixed periodically by using forecasting techniques, hence, productivity can be increased by making best uses of inputs or resources

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by maximum utilisation of capacity. Efficiency is doing correctly whereas effectiveness is doing the correct things. Increasing the effectiveness that is identifying how things can be done in a better way and implementing them, is also one of the objectives of the firm. Care should be taken that efficiency is increased for doing the correct things and not the incorrect ones. Efficiency should not be increased at the cost of effectiveness. Other objectives of operations can be achieved 100% conformance to predecided standards of quality or raising the conformance level, reducing the time required for the conversion. All these are performance objectives of the organisation. The organisation may also adopt cost control objectives by minimising the explicit and implicit costs.

OPERATIONS MANAGEMENT DECISIONS

Operations management decisions can be discussed in several different ways, which are as follows:

Periodic and Continual Decisions: Periodic decisions are concerned with decisions which have to be taken periodically. Such decisions can pertain to selection, design and updation. Decisions pertaining to selection can be regarding the products, processes, equipments, location, layout, workforce. Decisions pertaining to design can be regarding the design of products, machineries and equipments, jobs, methods, remuneration system, operating and control systems and formulation of various systems and procedures. Decisions pertaining to updation would include modifying the system according to the changes in the environment and on the basis of feedback.

Continual decisions are decisions which have to be taken on a continuous basis. Decisions pertaining to setting of targets, schedules, sequences, maintenance

and control of inventory, quality and production, are all covered under continual decisions.

Planning, Organising and Controlling Decisions: Operations management decisions can also be viewed as consisting of planning, organising and controlling decisions. Planning decisions would pertain to the planning of the conversion system and utilisation of the conversion system. Once the conversion process and its utilisation has been planned the need is to take several organising decisions pertaining to staff, work design, standard of production, remuneration, sequencing and structuring of operations etc. Controlling decisions would pertain to control over quantity, quality, time, inventory, cost and maintenance.

Strategic and Operational Decisions: Operations management decisions can also be viewed as comprising of strategic and operational decisions. Strategic decisions are long-term decisions and are decisions which organisations take to meet their aims and objectives taking into account the changing environment. Strategic decisions are difficult to change once taken. Strategic decisions can pertain to selection of product and product design, selection of process, facilities, location and layout, materials handling and capacity planning. The operational decisions are short-term decisions which aid in the fulfilment of the strategic decisions. Operational decisions pertain to production planning, scheduling and control; inventory planning and control, quality control, work and job design, maintenance and cost control.

Operations management decisions need to be reviewed and updated on a periodic basis in order to take into consideration the changes in the environment. Also the conversion system should be monitored on a continuous basis and feedback regarding actual vs. planned performance should be utilised to find tune of the conversion process.

TYPES OF PRODUCTION SYSTEMS

There are four types of production systems described as follows:

| Production Systems | Description |
|---|---|
| Mass Production System or Assembly Line | The processing of materials from the input to the output stage takes place in a sequence in a linear flow. Machineries used in mass production system are specific. Mass production system is appropriate for producing high volume low variety outputs. The main problem in a mass production system is line balancing and reducing bottlenecks. |

| Production Systems | Description |
|------------------------------|--|
| Batch Production System | Batch production system is appropriate for more variety and small volume of outputs. The outputs are produced in batches and stored. The flow of materials from the input to the output stage is not linear. The demand is met out of the inventory of stored outputs. Whenever the inventory level of a certain output falls below a certain level, production for that output is called for. In a batch production system a single machine is used for processing several products. The major problems in a batch production system are designing an optimal layout plan, working out an aggregate production plan, allocation of jobs to machines, determining the optimum inventory level and scheduling and sequencing of operations. |
| Job Shop | A job shop production system is highly flexible and can accept a vast variety of jobs as according to the demand. The output is of high variety and low volume. Material flow in a job shop from the input to the output stage is non-linear and complex. The processing in a job shop can be carried out on the basis of various criteria or rules. The rule can be shortest processing time, Earliest due date, first come first served etc. The main problem in a job shop production system is deciding the criteria or rule of processing. |
| Unit Manufacture of Projects | This type of production system is appropriate for manufacturing large sized products such as airplanes or ships. The products cannot be carried to the facilities, hence, the facilities (machineries and manpower) are brought to the product location. The production is undertaken as a project. The project is managed using the concepts of PERT/CPM. |

**MANAGEMENT OF MATERIALS
IN PRODUCTION SYSTEMS**

Materials play a very important role in the conversion process. In several industries, materials account for almost 60-70% of the cost of production. Proper management of materials can lead to a cost reduction of 15-20%.

The approaches to materials management are several and all the approaches need to be applied in an integrated manner for achieving the best results. The various approaches to materials management are as follows:

Analysis of the Purchase Price and Value of Materials: An analysis of the purchase price and value of materials can aid in reducing prices and increasing value of purchased materials through better sourcing, better vendor selection etc.

Materials Handling: The production facilities should provide for optimum materials handling. Excessive handling of materials should be avoided but availability of materials should be ensured at the point of requirement. All the required materials handling equipments as well as machineries should be provided for.

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Inventory Control: The inventory of materials should neither be in excess nor in shortage, but should be maintained at an optimum level so as to avoid increased storage and inventory carrying costs and also to ensure availability and avoid risks associated with shortages.

Stores Management: The layout of the stores should enable quick and easy access of materials. The store should be well maintained, clean and ventilated to keep wastages at minimum.

Waste Management: Wastes generated at each stage of the conversion system should be analysed and attempted to be reduced if not eliminated. Recycled waste products should be used as inputs as far as possible.

CONCEPTS IN SYSTEMS LIFE-CYCLE

The life-cycle concept holds that all systems pass through four stages which are namely: Introduction, growth, maturity and decline. The operations system comes into existence with the formulation of corporate goals and choice of output and setting up of the operations facility. Teething problems are eliminated in the growth stage and before reaching maturity the system achieves full capacity and economies of scale. After having reached at saturation point there is a decline in growth rate. The organisation needs to now relook its objectives after considering the changes in the external environment and take strategic decisions regarding revival, salvation or starting new business. All decisions including investment decisions pertaining to operations should be taken by considering the entire life-cycle of the system and not only a particular stage.

ROLE OF SCIENTIFIC METHODS IN OPERATIONS MANAGEMENT

Scientific method calls for systematic and objective approach and application of reason and logic to solve problems. The roles of various scientific

methods used in operations management are discussed as follows:

Industrial Engineering: It is concerned with creating apt systems of conversion comprising of men, materials, machineries and equipments. In order to create apt conversion systems industrial engineering borrows knowledge from several subjects such as mathematics, physical and social sciences and engineering.

Models: Models can be used for representing real life situations including conversion systems. Models can be mathematical or structural. Structural model can depict a detailed description of the real setup on a reduced scale. Mathematical models provide mathematical relations between various entities of a system. Mathematical models can be used for analysing the real system by filling in the appropriate coefficients.

Computers: Computers help in providing speedier solutions to problems and automating several processes and activities which are repetitive. Computers can be used for data processing, management information, decision analysis and communication purposes.

Behavioural Sciences contribute in designing the appropriate organisation structure, design of work, remuneration and performance appraisal systems.

BRIEF HISTORY OF OPERATIONS MANAGEMENT

A social change in the industrial revolution era which demanded the respect of all citizens and downfall of dictatorships gave birth to classical and behavioural schools of thought that identified factors which motivated people to work. The classical school of thought focused on the technical and scientific aspects while the behavioural school of thought was concerned with the effect of operations on human behaviour.

Following is a brief time line on the evolution of the subject of Operations Management:

| | | |
|-----------|--|-----------------|
| 1776-1911 | | |
| 1776 | Division of Labour | Adam Smith |
| 1832 | Division of labour and assignment of jobs by skills and time study basis | Charles Babbage |
| 1878-1911 | Job analysis and job design to increase efficiency and principles of scientific management. The principles mainly described: replacement of thumb's rule by scientific | F.W. Taylor |