

# *Management Science*



## **INTRODUCTION**

Management science is an approach to decision making based on the scientific method, makes extensive use of quantitative analysis. It uses a scientific approach to solving management problems. It encompasses a logical mathematical approach to problem solving.

Management science, also known as operations research, quantitative methods, etc.. involves a philosophy of problem solving in a logical manner.

## **MEANING**

Management science is the use of scientific methods and ideas to understand business and management problems and decisions, or the formal study of management

## DEFINITIONS

- Management science is the study of statistical methods, such as linear programming and simulation, in order to analyze and solve organizational problems.
- Management Science is concerned with developing and applying models and concepts that help to illuminate management issues and solve managerial problems.
- According to James Lundy, " Operations Research is the sophisticated name given to multi disciplinary problem oriented approach to the top management problems."
- According to T.L Satly, "Operations Research is the art of giving bad answers to the problems where otherwise worse answers are given.
- Churchman, Ackoff and Arnoff defined operations research as, "the application of scientific methods, techniques and tools to operation of a system with optimum solutions to the problems".

# FEATURES

1. The operations research uses scientific methods for decision making problem.
2. It involves combined efforts of experts from various disciplines. That means it follows a multi- disciplinary approach.
3. Operations research studies all the aspects of a problem under study and it thoroughly to find optimum solution as a whole analyses
4. It provides bad answers to problems where otherwise worse answers are given.
5. It provides quantitative basis for analyzing complicated every day problem.
6. Operations research is a continuous process. It cannot stop on the application of the model to one problem, for this may create new problem in other sector sand the implementation of the decisions taken.
7. Operations research advocates a system approach and is concerned with optimization.

# SCOPE AND OBJECTIVES OF OPERATIONS RESEARCH

1. In defence operations
2. In industry
3. Planning
4. Agriculture
5. In hospitals
6. In transport
7. Research and development
8. Modern business Management
  - a) Finance , Budgeting and investment
  - b) Purchasing and Procurement
  - c) Production Management
  - d) Marketing Management
  - e) Personal Management
  - f) Research and Development

# OPERATIONS RESEARCH METHODOLOGY

## PHASES OF OPERATION RESEARCH OR MANAGEMENT SCIENCE

### 1. Perception and formulation of problem

In this phase Operations research team should formulate the management problem and it should be transformed as a research problem.

### 2. Set up a mathematical model for the problem

It is the next phase. After formulating the problem the next step is to develop a mathematical model. A mathematical model is a set of mathematical relationships. In most cases these relationship is expressed by way of equations or inequalities or in matrices.

### 3. Deriving solutions from the model

After the formulation of a mathematical model the next step is to determine the value of the decision variables that optimize the given objective function.

### 4. Testing the model

### 5. Establish control over the solution

### 6. Implementing the solution It is the most important phase.

## OPERATIONS RESEARCH OR MANAGEMENT SCIENCE MODELS

Most operations research studies involve the construction of a mathematical model. The model is a collection of logical and mathematical relationships that represents aspects of the situation under study. Models describe important relationships between variables; include an objective function with which alternative solutions are evaluated, and constraints that restrict solutions to feasible values

1. Physical Model (iconic model): It includes all form of diagrams, graphs and charts. They are designed to deal with specific problems.
2. Mathematical Model: It is known as symbolic models also. It employs a set of mathematical symbols to represent the decision variable of the system. They are most widely used in operations research. A symbolic or mathematical model consists of a set of equations which define and specify the relationship and interactions among various elements of decision problem under study

3. Analogue models (Schematic models): In this model a set of properties are used. An organization chart is a common analogue model. It represents the existing relationship between the various members of the organization
4. By Nature of Environment: We have
  - 1) Deterministic model in which everything is defined and the results are certain. Certainty is the state of nature assumed in these models. E.g: EOQ model
  - 2) Probabilistic Models in which the input and output variables follow a probability distribution. E.g.: Games Theory. These models are the products of an environment of risk and uncertainty.
5. By the extent of Generality: The two models belonging to this class are
  - 1) General models: It can be applied in general and does not pertain to one problem only.
  - 2) Specific model: It is applicable under specific condition only.



6. According to procedure:

1. Analytical model: Mathematical tools are used to solve a problem.
2. Simulation and Heuristic models: Simulation models are more flexible than mathematical modeling. It is a numerical solution method which helps to analyze a system to find its optimum solution through trial and error approach. Heuristic models employs some intuitive rules in the hope of generating new strategies which will result better solutions.

# OPERATIONS RESEARCH OR MANAGEMENT SCIENCE TECHNIQUES

## 1. Probability:

The probability concepts try to analyze uncertainties and bring out necessary data with reasonable accuracy for the purpose of decision making.

## 2. Decision Theory:

It is the other technique of operations research used in decision making. Decision making involves a number of steps such as define objectives collecting information, developing options, evaluating and making decisions and implementing the decisions. Decision making problem are formulated under certainty, uncertainty, risk, competition and conflict.

Under uncertainty the following are the criteria used to determine the optimal solution.

1. maximax criteria

2. maximin criteria.

3. minimax criteria.

4 Laplace criteria.

5. Hurwicz criteria.

### 3. Game theory:

In business situations conflict arises out of competition. Each firm tries to create a favorable environment for it to operate. Each firm applies a strategy knowing with the possible strategies of the competitor. Game theory helps in determining the best course of action for a firm in view of the expected counter moves from the competitors.

### 4. Linear programming:

It is one of the most important and most popular quantitative tools used in operations research. It is a method for selecting an optimal combination of factors from a series of interrelated alternatives, each subjective to limitation.

Linear programming consists of

1. Graphic method: It is the graphical solution of a linear programming problem.
2. Simplex method: The objective is to maximize profit or minimize cost, subject to constraints in respect of each variable.

## 5. Transportation problems:

It is a particular class of linear programming problem. The objective is to transport various amount of a single homogeneous commodity that are stored at several origins, to a number of different destinations in such a way that the destination demands are satisfied within the capacity of distribution origins and that the total transportation costs is minimum.

## 6. The assignment problem:

It can handle the problems of assigning a given number of agents each one to the same number of tasks so as to result in maximum efficiency or minimum cost. The assignment problems include assigning man to offices, classes to rooms, drivers to truck, trucks to delivery routes etc.

## 7. Dynamic programming:

This technique deals with the problems that arise in connection with multi period analysis and decisions. It is a general type of approach to problem solving and a particular equation used must be developed to fit each individual situation. The basic approach used in dynamic programming is to breakdown a problem into a series of problems in such a way that answer to the first sub problem can be used in deriving the solution to the next sub problem and so forth finding solution to the whole problem.

## 8. Sequencing:

This method helps to determine a sequence in which given jobs should be performed if the objective is to minimize the total efforts.

9. *Queuing theory:*

*Queuing theory or waiting line theory deals with analysis of queues and Queuing behaviour, and has been used for solution or problems pertaining to the optimization of effectiveness of defined functions with random times of arrivals and servicing. Queuing theory attempts to formulate, interpret for purposes of better understanding the queues and for the scope to introduce remedies such as adequate service and tolerate waiting*

10. *Network analysis:*

*Programme evaluation and review technique (PERT) and Critical Path method (CPM) are powerful management tools for planning and control of complex jobs involving a large number of activities.*

## 11. Simulation:

Simulation is an operations research technique that uses a computerized symbolic model in order to represent actual decision making under uncertainty for determining alternative course of action based upon facts and assumptions. It is a numerical solution method which helps to analyze a system to find its optimum solution through trial and error approach.

## 12. Replacement theory:

This theory suggested the determination of the time when items of plant should be replaced. It is concerned with the problems of replacement of machines, electricity bulbs, etc due to their deteriorating efficiency, failure or breakdown.

## 13. Non Linear Programming:

It is that form of programming in which some or all the variables are curvy linear.

#### 14. Goal programming:

Goal programming deals with problems having multiple objectives. It is technique quite similar to linear programming.

#### 15. Probabilistic programming:

It is also known as stochastic programming which refers to linear programming that includes an evaluation of relative risks and uncertainty in various alternatives of choice for managerial decisions.

#### 16. Markov analysis:

The Markov analysis is a method of analyzing the current movement of the same variable in an effort to predict the future movement of the same variable. It was a technique developed by Markov - a Russian Mathematician early in the 20th century. As a management tool, it is used to analyze the behaviour of consumers in terms of their brand loyalty and their switching from one brand to another



## ADVANTAGES OF MANAGEMENT SCIENCE

1. Better Decisions
2. Better Control:
3. It helps to Improve Productivity
4. Better Coordination

## LIMITATIONS OF OPERATIONS RESEARCH OR MANAGEMENT SCIENCE

1. Tries To Find Out The Optimal Solution Taking All The Factors Into Account
2. Non Consideration Of Intangible Factors
3. Job Of Specialists
4. Costly
5. Difficulty In Implementation
6. Difficulty In Selection Of Techniques
7. Not A Substitute For Management
8. Distance Between Manager And Operations Researcher\dependence On An Electronic Computer
9. Dependence On An Electronic Computer
10. Disconnected From The Real Business Conditions