

UNIT 1: Fundamentals of Decision Making

DIFFERENT TYPES OF MODELS AND THEIR USES.

• Meaning of a model

A model is defined as an idealized representation or an abstraction of some real-life system, whether such system refers to a problem, process, operation, object or event.

The objective of a model is to provide a means for analyzing the behaviour of the system for the purpose of improving its performance.

• Advantages of a model.

1. An operations research model provides a good grip over the problem. It indicates the limitations and domain of the activity.
2. An operations research model provides a logical and systematic approach to the problem.
3. They indicate the scope and limitation of an activity.
4. They provide economic description and explanation of the operations of a system.

Classification of operations Research Models.

Classification by degree of abstraction

1. Language Model
2. Concrete Model

Classification by purpose

1. Descriptive Models
2. Normative or prescriptive model.

Classification according to behaviour characteristics

1. Static Models
2. Dynamic models.

Classification according to structure

1. Iconic (Physical) model.
2. Analogue (Schematic) model
3. Symbolic (Mathematical) model

Classification according to the procedure of solution

1. Analytical model
2. Simulation model.

Classification by nature of the environment

1. Deterministic model
2. Probabilistic Model

An overview of the operations Research models in practice.

TYPES OF O.R. MODELS.

1. Allocation Models
2. Assignment Models
3. Decision Models
4. Inventory Models
5. Queuing Models
6. Replacement models
7. Sequencing models
8. Network Scheduling models
9. Simulation Models
10. Competitive (Game Theory) models
11. Markov-chain models
12. Combined O.R. models

1. Allocation Model.

(a) Whenever there are a number of activities to be performed, alternative ways of doing them, and limited resources (or facilities) for performing each activity in the most effective manner, there is an allocation problem of these limited or scarce resources.

- (b) The problem is to combine activities and resources in an optimal manner so that overall efficiency is maximized i.e., profit is maximized and the cost is minimized.
- (c) When the constraints are expressed as linear equations this is known as 'linear programming'.
- (d) The LP model can effectively be used to deal with the problem of making optimal allocation of scarce (limited) resources to competing products (or activities).
- (e) **For instance,** determination of optimal product mix, media and investment portfolio selection,

2. Assignment models.

- (a) The simplest type of allocation model involves the assignment of a number of jobs to the same number of men (resources). This is called an assignment problem.

1b) This problem type becomes more complex if some of the job requires more than one resource and if the resources can be used for more than one job. An examples of this is "transportation problem"

3. Decision Models.

Most of the business problems involve a certain degree of uncertainty about the future. The use of probability theory enables a manager to calculate the probabilities of occurrence of various events in a business problem.

The decision models are extremely useful in determining the degree of uncertainty and the extent to which it may be reduced.

For instance, if a client wants to evaluate various projects with different investments and outcomes, decision models such as "a decision tree" may be very helpful in selecting the project with maximum payoff.

4. Inventory Control Models.

When to buy, how much to keep in store are some of the questions which production managers, purchase managers and material managers address themselves to.

Inventory control models provide rational answers to these questions in different situations of supply and demand for different kinds of materials.

Inventory control models help managers to decide reordering time, reordering level, optimal ordering quantity.

5. Queuing (or Waiting Line) models

Waiting line theory (or queuing theory) deals with the situation in which queue is formed.

Waiting lines at any service centre are a common phenomena and queuing theory is devoted to mathematical study of waiting lines.

Queueing theory has had application in solving problems concerned with traffic congestion, servicing machines subject to breakdown, determining the level of service force, receipt and withdrawal counters in a commercial bank.

If we assume that there are costs associated with waiting line and if there are costs of adding more channels (service facilities), we want to minimize the sum of costs of waiting and the cost of providing service facilities.

Waiting line theory helps to make calculation like expected number of people in the queue, expected waiting time in the queue, expected idle time for the server.

These calculations can then be used to determine the desirable number of service facilities.

Queueing models provide the management with information regarding the optimal number of service facilities to possess in order to balance the trade-offs between the cost of having too few or too many facilities.

6.

Replacement Models

The problem of replacement is encountered in systems where machine or capital assets are the main job performing units.

The efficiency of an item deteriorates with time or sometimes, the item fails completely. Hence, the replacement becomes necessary.

Sometimes an old machine becomes outdated or the new machine/equipment offers more economical or efficient service.

7.

Sequencing Models.

Such models solve problems where effectiveness measured in terms of cost, time, mileage (etc) depends upon the sequencing / sequence of performing given jobs.

This helps to determine a sequence in which given jobs should be performed if the objective is to minimize the total effort, or relevant costs.

8 Network Scheduling Models.

Network scheduling is a technique used to plan, schedule and monitor large projects.

The technique aims at minimizing trouble spots such as delays, interruptions and production bottlenecks by identifying critical factors and coordinating various parts of overall job.

Two basic techniques in network scheduling are Programme Evaluation and Review Technique (PERT) and Critical Path Method (CPM).

9 Simulation Models.

The simulation techniques allow the modern managers to examine the probable consequences of his decisions without the risk of real life experimentations.

In other words, simulation is often a practical way to substitute a model for the actual system or a full scale prototype. Further, if the results of experimentation with the simulation model indicate the modification or an improvement, the manager can more confidently

decide to implement the corresponding change in the real system.

10. Competitive (Game Theory) models.

One of the most important variables affecting the success of an organization is its competition. Clearly, the ability to predict the actions of competitors would be advantageous for any organization. Game Theory is a modelling technique for assessing the impact of a decision on one's competitors.

11. Markov-Chain Models.

Markovian models have been successfully applied to analyze consumer buying patterns, to forecast bad debts, for planning personnel needs etc.

12. Combined O.R. models.

Several preceding O.R. models can be brought together to produce a new group of O.R. techniques for managers. A production control problem usually includes some combination of inventory allocation and waiting line models.