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OPERATIONS RESEARCH IN DYNAMIC MANAGEMENT

This paper seeks to introduce a mathematical tool in a non-mathematical form for the betterment of managerial decision making process.

The tool is Operations Research (OR) consisting of different techniques each dealing with peculiar situation of decision making.

(1)

The accomplishment of management function has become much more complicated in todays changing economic and social environment. In case of industrial management, the chain of decisions starts from the procurement of Raw Materials and ends with despatch of finished goods.

These decisions have to do with every conceivable physical and organisational problem ; they may deal with various facts : Financial planning, marketing and distribution of output, expansion of production facilities, inventory procurement and control etc. The management is interested in having an overall view of the methods of optimising the profit and also in a bid to take these decisions on a scientific basis.

Intuitively, in all decisional problems, what is required is to select one from a set of alternative courses of action, considered to be the best. To judge which is the best, there must be some criteria that values the relative worth of alternative courses and a system is required to forecast the performance of each such alternative action.

Techniques have been evolved in business houses to reach at sophisticated decisions. The basic test of any such technique is the 'quick' with which the decisions are taken.

OR is a technique developed to arrive at quick solutions of multi-disciplinary problems.

(2)

Initially the OR was used in the Second World War in various types of military operations. The experts applied careful scientific analysis backed by simple statistics and the results achieved were beyond expectations. "This type of activity was considered to be so valuable by Americans military leaders that military OR functions were not discontinued at the end of War". (1) It was felt that the OR approach could be applied in decision making problems in strategic situations met within industry, agriculture and various fields of economics.

OR has been defined in various ways. Simply stated it is a tool employed to increase the effectiveness of managerial decisions.

James Lundy writes—

"OR is the sophisticated name given to a multi-disciplinary problem-oriented approach to the top management problems". (2) It involves the application of the scientific methods in situations where executives require description, prediction and comparision for the purpose of making decisions.

Morse & Kimble defines OR as "a scienfific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control". (3)

Charchman etc. says "OR is the application of scientific methods, techniques and tools to problems involving the operations of systems so as to provide those in control of the operations with optimum solutions to the problem". (4)

Chorafas defines OR as "a mathematical bais for study and analysis of engineering and management problems for the purpose of making the soundest decisions possible". (5)

OR in the final analysis is a scientific methodology which is applied to the study of the operations of large complex organisations or activities with a view to assessing the overall implications of various alternative courses of action, thus providing an improved basis for management decisions.

Based on above discussion, some of the characteristic of OR are worth-mentioning :

1. It involves the use of mathematics to describe the problem quantitatively. OR is a "field of applied mathematics and statistics whose concern is the developing of sets of standard model, as well as their modification for practical application". (6)

2. OR is concerned with situations where following difficulties arise :

   (a) Numerous alternative courses of action are available and the management is fully aware of the consequences of each of them taken separately.

   (b) The result of a course of action is not determinable and the management has to deal with probabilities and chances.

3. It involves the concept of optimisation. It strives for that mode which is considered to be the best or optimum one for achieving the established task.

4. OR is operated by a team of managers, engineers, mathematicians and economists and other experts. The very idea is to solve such problems which are complicated and not controllable by a single manager and require quick solutions. The use of electronic data pressing is vital.

Due to the complications involved, OR project is broken up in the following phases :

1. Perception and formulation of the problem.

2. Setting out or construction of a model of decision process.

3. Specification of alternative courses open.

4. Solution of the model evaluating the outcome of each course of action on the basis of given criterion.

5. Selection of a particular course and resolution of the decision process.

6. Preimplementation test and establishment of control over the solution with a degree of precision.

7. Implementation of the decision reached.

Thus the task of operations Researcher may be said to consist of studying an operation ; selecting variables to describe the operation ; investigating the mathematical relationships of the variables ; selecting objectives, measures and criteria of system performance and finding means to improve or optimise the system's functioning according to the selected measures and criteria.

Operations Researcher actually determines what factors influences the state of affairs and tries to measure them. All these measurements are then incorporated into a generalised system. The OR deals more in experiments and induction rather than in analysis and deduction.

(3)

OR is not one rather it consist of many techniques. Some of the techniques are :

1. LINEAR PROGRAMMING :

It is a method for selecting an optimum combination of factors from a series of inter-related alternatives, each subjective to limitation.

It involves the development of linear equations to obtain the best solution for the allocation problem. An allocation problem ". . . arise whenever there are a number of activities to perform, but limitations on either the amount of resources or the way they can be spent prevent us from performing each separate activity in the most effective way conceivable. In such situations we wish to allot the available resources to the activities in a way that will optimise the total effectiveness" (7). Linear Programming consist of—

(a) *The Simplex Method* : This aims at maximising or minimising a given function, subject to constraints in respect of ea ch variable.

(b) *The Transportation Method* : This deals with the problems of matching the origins (stores, warehouses, factories) with the outlets (process centre, market etc.) at minimum cost of distribution and transportation.

(c) *The Assignment Method* : 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.

2. DYNAMIC PROGRAMMING :

The technique deals with the problems that arise in connection with multiperiod analysis and decisions. In contrast to Linear Programming, there does not exist a standard mathematical formulation of Dynamic Programming, rather it is a general type of approach to problem solving and a particular equation used must be developed to fit each individual situation.

However, the basic approach used in Dynamic Programming is to break down a problem into a series to 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 finally giving solution to the whole problem.

This technique relies on the principle of optimatity formulated by Richard Bellman. "An optimal policy (set of decisions) has the property that, whatever the initial state and initial decisions are, the remaining decisions must constitute an optimal policy with respect to the state resulting from the first decision". (8)

3. SEQUENCING :

This method solves problems where effectiveness measure (interms of cost, time, mileage etc.) depends upon the sequence of performing given jobs. This helps to determine a sequence in which given jobs should be performed if the objective is to minimise the total efforts.

4. GAME THEORY :

This technique deals with the situations where two or more (finite) individuals are making decisions involving conflicting interests. However, the final decision depends upon the decisions of the parties concerned. The basic assumptions made are that every competing party will adopt the policy most unfavourable to us and therefore we are required to select the best position among the worst

positions.   In such situations, one's favourable item is unfavourable to other.

5.   PROGRAMME EVALUATION & REVIEW TECHNIQUE (PERT) :

This method is used to design a network or schedule. A network is a sort of master chart covering the entire programme.   It shows the events and activities arranged in order in which they occur.   For this purpose a project is broken up into its various components, and events are connected by activities. An event is   a   specified accomplishment in the programme and the activity which is the actual performance of a task is represented as the time link between related events.

6.   SIMULATION :

Simulation may be used in situations of complex problems where no mathematical formulation may be available.   It makes use of random numbers to given solutions to complex problems involving a number of interacting variables.

In essence, it involves the use of a large number of trials and error investigations, seeking to discover the optimal policy.   The trials of course, are not performed in !actuality.   Instead, the experi- mentation occurs relatively inexpensively and quickly on papers and computer circuits utilising the data that correspond to the "real world" situation.

(4)

Faced with increasing complexities of production, sales, and marketing operations in a highly developed and competive economy the management must deal with inter-locking tasks involving decision making and control problems.

"To the extent to which the unaided human mind becomes unable to deal with the growing complexities of inter-locking factors and variables, OR techniques must be called in to solve those aspects of decision problem that are amenable to quantitative formulation integration and solution". (9)

The management can use Linear Programming in variety of situation e. g.,

1.   To determine the best location of plants, sales outlets etc.

2. To calculate the best schedule of machines loading for lowest cost.

3. To determine product mix for processing industry.

4. To allocate financial resources etc.

Hence linear Programming can be used to find optimum solution for interdependent activities in production cycle, transportation, distribution, labour allocation etc.

Inventory process constitute a separate class of important problems relating to when to order, how much to order ? These decisions involve optimisation of inventory considering cost factors. Two factors are worth-mentioning—Decreasing cost of orders and increasing cost of tied up capital. A balance is required in these opposite forces for practically all kinds of inventory—Raw Material, goods in process, and finished goods.

OR techniques have been developed which shows what inventory policy and corresponding quantity decision will minimise inventory cost. The Dynamic Programming is the most important and useful technique to deal with the problems of inventory replenshment and scheduling of production process to keep pace with the demand for the product. The objective is to plan the production in such a way that demand is met at all times but total cost of inventory storage and financing is minised.

PERT can be used effectively for managerial planning and control activities. From a general view point, PERT aids the management in guiding and directing team efforts more effectively. It permits advance planning, indicates current progress and warns of potential future trouble spots when there may still be time to avoid them. More specifically, PERT shows its value most strikingly when special projects of a new kind are undertaken. Management must then have an aid in handling the uncertainties regarding time-schedules, corrdinating of many activities and control of the costs involved. PERT is such a tool.

CONCLUSION :

The OR is growing faster in the field of Business Decisions, with growing competion in the business world. The challenging frontiers of managerial problems are easily coped with the technique.

The contribution of OR is that it finds further precision to the evaluation process and that it provides a mechanism of supplying these evaluations concisely before major decisions are made.

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