

Utpal Saikia
Dept Of Mathematics
JIST::Jorhat-10
Mail: utpal_no1@rediffmail.com

Q: Discuss the origin and development of Operation Research.

Ans: The term operations research was coined in the year 1940 by Prof P.M.S Blackett and his team. The name was given on the basis of the research carried out by Professor and his team on military operations of England during World War II. The objective of the team was to find out the most effective allocation of limited military resources to the various military operations and to the activities with each operation. Their work also included the effective use of newly invented radar, allocation of British Air Force planes to missions and the determination of best patterns for searching submarines. Since the team was carrying out research on military operations so the term was named after it. Although the term was coined in the year 1940, it was in 1885 when Ferderick W.Taylor emphasized the application of scientific analysis to methods of production, that the real start of OR took place. Taylor conducted experiments in connection with a simple shovel. The aim of his experiment was to find that weight load of ore moved by shovel which would result in maximum of ore moved with minimum fatigue. Along with Taylor, the work of Henry L. Gantt on Job-Scheduling, A.K Erlang for his work on the problem of congestion of telephone traffic, H.C Levinson for his scientific analysis to the problems of merchandising were worth mentioning. Their experiment was the first step for the development of OR. The first industrial revolution brought a tremendous change in the field of OR. The growth of the industries, the replacement of man by machines as a source of power, improved means of transport and communication results in a new type of problem called executive-type problems. These problems were solved satisfactorily using OR techniques.

After world war II the OR techniques soon spreads from military to government, industrial, social and economic planning. In 1950 OR was first introduced as a subject for the academic study in American Universities and now the OR course is a part of Mathematics, Statistics, Economics, Commerce, Management and Engineering. Of late OR activities have spread to diverse fields such as hospitals, libraries, city, planning, transportation systems, crime investigations etc. In a nutshell we can say that Operations Research is gaining popularity with the flow of time in every field of life.

Q: Discuss about operations research in India.

Ans: In India, operations research came into existence with the opening of an OR unit in 1949 at the Regional Research Laboratory in Hyderabad and Defence Science Laboratory to tackle the problems of stores, purchase and weapon evaluation. In 1953 an OR unit under Prof. P.C Mahalonobis was established in the ISI, Kolkata to apply OR methods in national planning and survey. Prof. Mahalonobis made the first important application of OR in India in preparing the draft of the second five year plan. Soon the popularity of OR began to flourish in India, and as a result India got her first journal on OR named 'Opsearch' in 1963. Numerous Indian journals after 'Opsearch' started promoting the cause of operations research.

For academic studies the first course on OR was started by Delhi University in M.sc level along with IIM Kolkata and Ahmedabad in MBA in the year 1963. At present most of the institutes and universities in India provides OR as a subject. In the Industrial sector, organized industries in India are applying OR techniques for the growth and swift development of their business. A number of organisations are also

utilizing OR techniques for solving problems relating to staffing, production , planning, blending, product mix, maintenance, inspection, advertising, capital budgeting, investment etc.

Q: Define OR? What are the limitations of OR techniques?

Ans: Operations research can be simple defined as the research of operations. An Operation may be called a set of acts required for the achievement of a desired outcome. OR is mainly concerned with study of the operations of complex, inter-related acts performed by any organisation of men, machine, and man machine units. Many definitions of OR have been suggested from time to time. The most comprehensive and modern definition of operation research can be summarized as

OR is the application of modern methods of mathematical science to complex problems involving management of large systems of men, machines, materials and money in industry, business, government and defence. The distinctive approach is to develop a scientific model of the system incorporating measurement of factors such as chance and risk to predict and compare the outcomes of alternative decisions, strategies or controls.

Limitations of Operations Research

- 1. Mathematical models which are essence of OR do not take into account qualitative factors or emotional factors which are quite real. All influencing factors which cannot be quantified find no place in mathematical models.**
- 2. Mathematical models are applicable to only specific categories of problems.**
- 3. OR tries to find optimal solution taking all the factors of the problem into account. Present day problems involve numerous such factors; expressing them in quantity and establishing relations among them requires huge calculations.**
- 4. Being a new field, generally there is a resistance from the employees to the new proposals.**
- 5. Management, who has to implement the advised proposals, may itself offer a lot of resistance due to conventional thinking.**
- 6. Young enthusiasts, overtaken by its advantages and exactness, generally forget that OR is meant for men and not that men are meant for it.**

Q: What is the role of OR in decision making?

Ans: Decision is a pivotal word in managing. Operations Research or management science is the science of managing. As is known, management is most of the time making decisions. It is thus a decision science which helps management to make better decisions.

The essential characteristics of all decisions are- objectives, alternatives and influence factors. By studying these characteristics well and then by improving them, the decision itself can be improved.

It is the scientific quantification used in OR, which helps management to make better decisions. In OR, the essential features of decisions, namely objectives, alternatives and influencing factors are expressed in terms of scientific quantifications or mathematical equations. This give rise to certain mathematical relations, termed as a whole as mathematical model. The essence of OR is such

mathematical models. With the advance of science and technology, decision making in business and industry has become highly complex and extremely difficult as the decision makers have to faced with a large number of interacting variables, which are numerous and dynamic so at times do not lend themselves to neat quantitative treatment. Along with this they have to consider the action of the competitors over which they have no control. In these situations Operations Research comes to help. For different situations different models are created and with the help of OR techniques a much more improved decision is taken. As a whole we can say that every one of us have to make decision starting from major issues like to choose a carrier to minor decisions like to purchase at a particular shop, OR provides us the much needed tools for improving the various decisions.

Q: Discuss the scope of OR in financial management?

Ans:

Operations research has wide scope and has been successfully applied in the following areas of financial management:

1. Cash Management

A financial manager is responsible for adequate supply of funds to all the sections, departments and units of the organisation as adequate funds are essential for their proper function throughout the year. Linear programming techniques are helpful to determine the allocation of funds to each section. L.P. techniques have also been applied to identify sections having excess funds; these funds may be diverted to the sections that need them.

2. Inventory Control

In big organisations the amount invested in inventories can run into millions of rupees. Inventory control techniques of OR can help management to develop better inventory policies and bring down the investment in inventories. These techniques help to achieve optimum balance between inventory carrying costs, ordering costs and shortage costs. They help to determine which items to hold, how much to hold, when to order and how much to order.

3. Simulation Technique

Simulation considers various factors that affect the present and projected cost of borrowing money from commercial banks, and tax rates, etc. and provides an optimum combination of financing (debt, equity or retained earnings) for the desired amount of capital. Simulation replaces subjective estimates, judgement and hunches of the management by providing reliable information.

4. Capital Budgeting

It involves evaluation of various investment proposals (*viz.* market introduction of a new product or replacement of an equipment by a new one). Often the decisions have been made by considering internal rate of return or net present values. These methods, however, do not consider the risk factor in the venture. Risk factors can be calculated if the probability distributions of cash flows can be ascertained, say from past data. Hiller's and Hertz's models (simulation) and decision trees in conjunction with EMV can be usefully employed to evaluate the various investment proposals/projects. OR techniques of linear programming, integer programming and dynamic programming have also been useful in selection of optimal investment portfolios (with or without estimates of risk).

Q: Discuss the scope of OR in management?

Ans: Some of the areas of management where OR techniques have been successfully applied are:

1. Allocation and Distribution

- (a) Optimal allocation of limited resources such as men, machines, materials, time and money.
- (b) Location and size of warehouses, distribution centres, retail depots, etc.
- (c) Distribution policy.

2. Production and Facility Planning

- (a) Selection, location and design of production plants.
- (b) Project scheduling and allocation of resources.
- (c) Preparation of forecasts for the various inventory items and computing economic order quantities and reorder levels.
- (d) Determination of the number and size of the items to be produced.
- (e) Maintenance policy.
- (f) Scheduling and sequencing of production runs by proper allocation of machines.

3. Procurement

- (a) What, how and when to purchase at the minimum procurement cost.
- (b) Bidding and replacement policies.

4. Marketing

- (a) Product selection, timing and competitive actions.
- (b) Selection of advertising media.
- (c) Demand forecasts and stock levels.
- (d) Customer's preference for size, colour and packaging of various products.

5. Finance

- (a) Capital requirements, cash-flow analysis.
- (b) Credit policies, credit risks, etc.
- (c) Profit plan for the company.
- (d) Determination of optimum replacement policies.

6. Personnel

- (a) Selection of personnel, determination of retirement age and skills.
- (b) Recruitment policies and assignment of jobs.

7. Research and Development

- (a) Determination of areas for research and development.
- (b) Reliability and control of development projects.
- (c) Selection of projects and preparation of their budgets.

From all the above areas of applications, it can be concluded that OR can be widely used in taking timely management decisions and can be also used as a corrective measure.