



Applications of operation research in management

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ABSTRACT

This article includes the brief about operation research and its applications in management field. Operation Research is a tool of quantitative analysis; it is a systematic and scientific procedure to find the A problem regarding the process and the management and it supports to choose an optimum solution to those problems. It is an effective and efficient key tool for decision maker through a quantitative manner. It consists of several methods to solve problems like assignment method, transportation methods, linear programming methods, sequencing, Scheduling, pert and cpm, decision tree, theory of games and queuing theory and some other techniques. These models support to plan the product, process and profit maximization of the organization. Through this we get the best way of Managing the financial and non financial activities of the organizations. And the organization able to produce a quality product with least price so it leads to overall development of the organization. Some other applications of operation research in management through finance and accounting, marketing, purchasing, inventory, production management, maintenance and project scheduling,

Personnel management and decision support system. This article consist a brief of different tools of operation research which are used in management.

KEY WORDS: *Operation, Profit Maximization, Quantitative, Optimum & Scientific Method*

INTRODUCTION TO OPERATION RESEARCH:

Operations-

The activities carried out in an organization to complete a particular task or work

Research-

The process of observation and testing characterized by the scientific method, Situation problem statement, model construction, validation, experimentation and candidate solutions

OPERATIONS RESEARCH MEANS:

- Is a quantitative approach to decision making based on the scientific method of problem solving Operations Research is the scientific approach to execute decision making, which consists of
- The art of mathematical modeling of complex situations
- The science of the development of solution techniques used to solve these models
- The ability to effectively communicate the results to the decision maker
- Is a systematic application of quantitative methods, techniques and tools to the analysis of problems involving the operation of systems

STEPS OF OPERATION RESEARCH:

- Defining the problem
- Formulating a mathematical model
- Solving the mathematical model
- Validating the solution
- Implementing the solution
- Modifying the model

- Establishing controls over the solution

DIFFERENT TECHNIQUES/MODELS OF OPERATION REASERCH IN PRACTICE:

There is no unique set of problems that can be solved by using OR techniques.

Several techniques have been discussed below

- **Inventory model**-this technique deals with how much to order at a point in time and when to place an order, the main objective of this model is to minimize the total cost of inventory which includes cost of holding, cost of shortage, cost of ordering.
- **Allocation model**- This technique used to allocate the resources to activities so as to optimize measure of effectiveness or maximum utilization of resources
- **Waiting line or queuing line method** – These models establish a trade-off between costs of providing service and waiting time of customer in the queuing system.
- **Game theory**- This model used to categorize the behavior of 2 or more competitors competing to achieve their conflicting goals. It explains type of strategy which would yield the best or worst outcomes.
- **Network models**- These models are applied to management of large scale projects. Here PERT/CPM techniques helps in identifying delay and project critical path. It leads to efficient use of resources.
- **Sequencing model**- These models are used to determine the sequence or order in which a number of task can be performed by a number of service facilities. In such a way that some measure the performance is optimize.

- **Decision analysis model-** This model deals with the selection of an optimal course of action given the possible payoffs and their associated probabilities of occurrence. These models are broadly applied to problems involving decision making under the risk and uncertainty.
- **Dynamic programming models-** These models are used where a problem requires optimization of multistage decision process. Here problem is divided into sub problems and then solves those sub problems sequentially until the solution to the original problem is obtained.
- **Markov-chain models-** These models are used for analyzing the system which changes over a period of time among various possible outcomes

BENEFITS OF OPERATION RESEARCH TO MANAGEMENT:

- **Structured approach to problem solving and decision making-** Predetermined or a substantial amount of time and effort can be saved in developing and solving or models if a logical and consistent approach is followed.
- **Critical approach to problem solving and decision making -**The decision maker will come to understand various components of the problem and accordingly select a mathematical model for solving the given problem. And problem solutions are examined critically and the effect of any assumptions' and limitations of such models.

FEATURES OF OPERATION RESEARCH IN MANAGEMENT PERSPECTIVE:

- **Technically Appropriate-** The solution should work technically, meet the constraints and operate in the problem environment
- **Reliable-** The solution must be useful for a reasonable period of time under the conditions for which it was designed

- **Economically viable**-Its economic value should be more than what it costs to develop it and it should be less than the investment which incur in hiring the OR.
- **Behaviorally appropriate**-The solution should be behaviorally appropriate and must remain valid for a reasonable period of time within the organization.

MAJOR APPLICATIONS OF OPERATION RESEARCH IN MANAGEMENT:

Most of industrial/government/business problems that can be analyzed by the Management used operation research approach have been arranged by functional areas as follows”

- **Finance and Accounting-**
Dividend policies, investment portfolio management, auditing, balance sheet and cash flow analysis
- **Marketing-**
Selection of product mix, marketing and export planning, advertising, media planning and packaging
- **Purchasing Procurement and Exploration-**
Optimal buying decisions and reordering with or without price quantity discount and transportation planning
- **Production Management-**
Facilities planning, location and site selection, production cost and methods, assembly line, blending, purchasing and inventory control
- **Maintenance and Project Scheduling-**
Maintenance policies and preventive maintenance
- **Personnel Management-**

Manpower planning, wage/salary administration, designing organization structure more effectively

- **Techniques and General Management-**

Decision support system and MIS, forecasting

- **Government-**

Economic Planning, optimal utilization of natural resources, social planning and energy

ESSENTIAL CHARACTERISTICS OF GOOD OPERATION RESEARCH MODEL:

- A good number should be capable of taking into account new formulations without having any significant change in its frame.
- The number of assumptions made should be as small as possible.
- It should be simple and coherent, i.e. number of variables used should be small.
- It should be open to a parametric type of treatment. Such situations are often forced when response to an advertising campaign or the customer acceptance of a new product is studied.
- A model should not take much time in its construction for any problem.
- It should express the relations and interrelations of action and reaction of cause and effect in operational situations.

IMPORTANT LIMITATIONS OF OPERATIONS RESEARCH:

There are a number of limitations of operations research which may be stated as follows:

- In the quantitative analysis of operations research, certain assumptions and estimates are made for assigning quantitative values to factors involved. If such estimates are wrong, the result would be- equally misleading.
- Many management problems do not lend themselves to quantitative measurement and analysis. Intangible factors of any problem concerning human behavior cannot be quantified accurately and all the patterns of relationships among the factors may not be covered. Accordingly, the outward appearance of scientific accuracy through the use of numbers and equations becomes unrealistic.
- The quantitative methods of operations research are many cases costly, elaborate and sophisticated in nature. Although complex problems are fit for analysis by tools of operations research, relatively simple problems have no economic justification for this type of quantitative analysis.
- Knowledge of some concepts of mathematics and statistics is prerequisite for adoption of quantitative analysis by the managers. According to the present training and experience of most managers, the actual use of these tools may be confined to a few cases.
- Operations research is not a substitute for the entire process of decision making and it does not relieve the managers of their task of decision making. In one phase of decision making viz., selection of best solution through the evaluation of alternatives, operations research comes into the picture.

Advantages of an operation research Model:

- It provides some logical and systematic approach to the problem.
- It incorporates useful tools which help in eliminating duplication of methods applied to solve specific situations.

- Models help in finding avenues for new research and improvements in a system.
- It indicates the nature of measurable quantities in a problem.
- They provide economic descriptions and explanations of the operations of the system they represent.

DISADVANTAGES OF OPERATION RESEARCH MODEL:

- They are only an attempt in understanding operation and should never be considered as absolute in any sense.
- Validity of any model with regard to corresponding operation can only be verified by carrying the experiment and relevant data characteristic.

RECENT TRENDS OF OPERATION RESEARCH:

Following is a list of current trends influencing O.R. and opportunity areas for O.R. professionals. Of course, these are only examples; opportunity is truly everywhere.

Opportunities in industries -

- *Academic:* Among INFORMS members, positions teaching at universities remain a strong source of employment. O.R. departments have revitalized themselves at engineering and business schools such as the University of Alberta, Indiana University, Villanova University, Georgia Tech, and Northwestern University. For more on O.R. opportunities and issues in academia, go to Issues & Strategies for Academics.
- *Agriculture and Food:* is discovering operations research applications for planting, procurement, and distribution.

- *Airline industry:* Although experiencing hard times, the airline industry is still a predominant area of employment, both at airlines and at consultants contracting to airlines.
- *Energy:* The oil industry was one of the first users of operations research techniques to help manage their refinery operations, and operations research technologies are heavily used by all the major oil companies.
- *Forestry:* In harvesting and at timber mills. Timber is a strong application area.
- *Health care:* Health care continues to offer a variety of uses for operations research, including quality assurance, the design of medical informatics, emergency room scheduling, resource modeling, and, in some cases, diagnosis.
- *Manufacturing:* Manufacturing organizations continue to use operations research to optimize factory operations. One category of manufacturing, semiconductor optimization, is seeing a vital use of O.R. professionals. O.R. professionals may also offer guidance in technology adoption. Warehouse optimization, tied to manufacturing, is a potential growth area. Supply chain planning, a key aspect of any manufacturing operation, is driven by operations research technologies.
- *Marketing:* Marketing departments use operations research to determine the best ways to target their diversified customer bases. Operations researchers can offer guidance on what are the right offers to give to the right customers, and when it is no longer profitable to target certain segments of the market.
- *Retailing:* Although retailing companies don't currently use O.R. heavily, clothing manufacturers and stores are exploring O.R. applications to forecast sales, plan purchasing and production, do pricing, and improve supply chain management.
- *Telecommunications:* Although experiencing difficult financial times, may again rely on operations researchers in various areas as the economy and the field stabilize.

- *Transportation:* Operations researchers perform logistics for air traffic control, trucking, and railroads. Real-time dispatching and delivery truck routing are important O.R. areas. The healthy package delivery field is one that continues to rely heavily on the work of O.R.
- *Opportunities in the public sector:* The public sector has offered opportunities in various areas, including school location, fire and ambulance station location, police and firefighter deployment, and policy science.
- *Homeland security:* Homeland security and related interstate and federal systems may represent opportunities for operations researchers, who can advise planners about where to spend and place resources within the system. O.R. can help the fight against terror via routing and rerouting traffic in case of terrorist attack, and the improvement of systems like the electrical grid.
- *Military:* Conceived during war, operations research remains strong in the military, where the services use O.R. for personnel force management, logistics, transportation, war gaming, strategic planning, tactical planning, and war theater optimization. Consultants to the military employ operations researchers, as well. The U.S. Bureau of Labor Statistics reports that in the United States, the military remains the largest employer of operations researchers in the Federal Government, and that many operations research analysts in private industry work directly or indirectly on national defense.
- *Municipalities and states:* These levels of government rely more on operations researchers to deal with highway traffic delays and the development of intelligent traffic systems.
- *Public health:* In public health, operations researchers have made important recommendations in drug treatment, AIDS prevention, and organ donation.

Recent Trends in operation research:

- *Data mining:* With the widespread emergence of very large databases, many different organizations are finding vital help from O.R. professionals in extracting the information they really want. O.R.'s data mining methods, whose use is growing rapidly, give superior solutions in diverse database-plumbing applications – such as predicting purchasing behavior, segmenting customers, detecting fraud, assessing credit risk, and anticipating customer attrition.
- *E-commerce:* Even after the dot.com bust, E-commerce offers opportunities in business-to-business and consumer areas of online purchasing, vendor purchasing models, online auctions, and supply procurement. In addition to sellers, bidders are looking to O.R. models for decision support on how to bid intelligently. Online grocers that make home delivery are another area of opportunity for operations researchers.
- *Environmental applications:* Operations researchers offer aid in pollution control and the design of systems to prevent shipping accidents.
- *Financial engineering:* Financial engineering and related work is seeing some instances of growth for operations researchers, with work in portfolio selection, portfolio models, and hedge fund strategies. Banks rely on risk management modeling, among other applications. Insurers rely heavily on operations researchers to do risk analysis and pricing. Some credit card companies use operation researchers to work on credit scoring.
- *Marketing:* Direct marketing models, customer segmentation, Customer Relations Management (CRM) – all rely on the service of operations researchers, both at the business-to-business and consumer level.
- *Revenue management:* The practice of retail management has extended from the airlines to hotels, cruises, car rental operations, and even gas pipeline operations.

- *Scheduling*: This continues to offer employment for operations researchers, with O.R. being used for sales forces, call centers, air traffic control, bus crewing, retail staffing, and hospital nurses.
 - *Conclusion*: Operation research is a part of management. It supports the management in effective manner to complete the task in a right direction. Operation research has its many useful application in various field like military, E-commerce, environment, scheduling, data mining etc. It helps management to take optimum decision when they face various problems.
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