

Introduction to Operations Research

Operation Research is a relatively new discipline. The contents and the boundaries of the OR are not yet fixed. Therefore, to give a formal definition of the term Operations Research is a difficult task. The OR starts when mathematical and quantitative techniques are used to substantiate the decision being taken. The main activity of a manager is the decision making. In our daily life we make the decisions even without noticing them. The decisions are taken simply by common sense, judgment and expertise without using any mathematical or any other model in simple situations. But the decision we are concerned with here are complex and heavily responsible. Examples are public transportation network planning in a city having its own layout of factories, residential blocks or finding the appropriate product mix when there exists a large number of products with different profit contributions and production requirements etc.

Operations Research tools are not from any one discipline. Operations Research takes tools from different disciplines such as mathematics, statistics, economics, psychology, engineering etc. and combines these tools to make a new set of knowledge for decision making. Today, O.R. became a professional discipline which deals with the application of scientific methods for making decisions, and especially to the allocation of scarce resources. The main purpose of O.R. is to provide a rational basis for decisions making in the absence of complete information, because the systems composed of human, machine, and procedures may do not have complete information

Definitions

According to the Operational Research Society of Great Britain "Operational Research is the attack of modern science on complex problems arising in the direction and management of large systems of men, machines, materials and money in industry, business, government and defense. Its distinctive approach is to develop a scientific model of the system, incorporating measurements of factors such as change and risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls. The purpose is to help management determine its policy and actions scientifically. "

Morse and Kimball described it as " a scientific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control".

Saaty considers O.R. as a tool for improving the quality of answers. He says, "O.R. is the art of giving bad answers to problems which otherwise have worse answers".

Miller and Starr state, "O.R. is applied decision theory, which uses any scientific, mathematical or logical means to attempt to cope with the problems that confront the executive, when he tries to achieve a thorough-going rationality in dealing with his decision problem".

Steps of Operations Research

Step I: Observe the problem environment

The first step in the process of O.R. development is the problem environment observation. This step includes different activities; they are conferences, site visit, research, observations etc. These activities provide sufficient information to the O.R. specialists to formulate the problem.

Step II: Analyze and define the problem

This step is analyzing and defining the problem. In this step in addition to the problem definition the objectives, uses and limitations of O.R. study of the problem also defined. The outputs of this step are a clear grasp of the need for a solution and its nature understanding.

Step III: Develop a model

This step develops a model; a model is a representation of some abstract or real situation. The models are basically mathematical models, which describes systems, processes in the form of equations, formulas/relationships. The different activities in this step are variable definition, formulating equations etc. The model is tested in the field under different environmental constraints and modified in order to work. Sometimes the model is modified to satisfy the management with the results.

Step IV: Select appropriate data input

A model works appropriately when there is appropriate data input. Hence, selecting appropriate input data is an important step in the O.R. development stage or process. The activities in this step include internal/external data analysis, fact analysis, and collection of opinions and use of computer data banks. The objective of this step is to provide sufficient data input to operate and test the model developed in Step III.

Step V: Provide a solution and test its reasonableness

This step is to get a solution with the help of model and input data. This solution is not implemented immediately, instead the solution is used to test the model and to find there is any limitations. Suppose if the solution is not reasonable or the behaviour of the model is not proper, the model is updated and modified at this stage. The output of this stage is the solution(s) that supports the current organizational objectives.

Step VI: Implement the solution

At this step the solution obtained from the previous step is implemented. The implementation of the solution involves many behavioural issues. Therefore, before implementation the implementation authority has to resolve the issues. A properly implemented solution results in quality of work and gains the support from the management.

The process, process activities, and process output are summarized in the following Table:

Process Activities	Process	Process Output
Site visits, Conferences, Observations, Research	Step 1: Observe the problem environment	Sufficient information and support to proceed

Define: Use, Objectives, limitations	Step 2: Analyze and define the problem	Clear grasp of need for and nature of solution requested
Define interrelationships, Formulate equations, Use known O.R. Model , Search alternate Model	Step 3: Develop a Model	Models that work under stated environmental constraints
Analyze: internal-external data, facts Collect options, Use computer data banks	Step 4: Select appropriate data input	Sufficient inputs to operate and test the model.
Test the model find limitations update the model	Step 5: Provide a solution and test its reasonableness	Solutions that support current organisational goal

