i) Origin & Development of Operation Research

The term operation Research was first coined in 1940 by McClosky & Trefthen in a small town, Bowdsey of the United Kingdom. This came into exisistence as military content. During WWII, military management called on scientist from various disciplines and organised them into a team to assist in solving strategies & tactical problem that is to discuss, evolve and suggest certain approaches that showed some remarkable progress. This new approach to systematic and scientific study or operation of system was called Operation Research or Operational Research.

i) Operation Research in India –

In India operation research came into existence in 1949 with the opening of Operational Research Unit at Regional Research Laboratory at Hyderabad. In 1953, an operational research unit was established in the India Statical Institute, Calcutta for the application of OR methods in national planning & survey. Operation Research society was formed in 1957 in India.

ii) Defination of operation research –

Due to various application giving precise definition is difficult but some of them are given below –

1. "Operational research is the application of scientific methods, techniques & tools to problems involving the operation of a system so as to provide those in control system with optimum soln to a problem.

2. "Operation Research is an art of giving bad answers to problem which otherwise have worse answers."

2) Methods to Get Models in Operation Research –
A mode in OR is a simplified representation of an operation or a process in which only the basic aspect or the most important feature of a typical problem under investigation are considered.

Types of Model – 1) Physical Models

1.) Iconic model – iconic model retain some physical properties & characteristic of system they present.

2) Analogue Model – The model represent a system by that set of properties different from that of original system does not resemble physically.

2) Symbolic Models

1) Verbal models – These model describe a situation in written or spoken language.

2) Mathematical model – these model involves the use of mathematical symbol/ letters, operators to represent various relationships among variables of system to describe its property.

3) Descriptive model –

This model simply describe some aspect of situation based on observation, survey, questionaire results or other available data of a situation and do not predict or recommend.

Eg – plant layout diagram

4) Predictive model –

these models are used to predict the out-comes due to a given set of alternative for problem. there model do not have an objective function as a part of model to evaluate decision alternatives.

5) Optimisation Models –

these model provide best or optimal solution to problem subject to certain limitation of use of resource.

6) Deterministic model –

If all the parameter, constants and functional relationship are assumed to be known with certainty when the decision is made, then the model is said to be deterministic. for a specific set of input there is uniquely determined output.

example – linear programming model.

2) Different phases of operation Research

i) Defination of the Problem

Problem defination involves defining the scope of problem under investigation. This function should be carried out by entire OR team. The aim is to modify identification three principal element of decision problem

I) Description of decision alternatives.

II) Determination of objective of study

III) Specification of limitation under which modeled system operates.

ii) Model Construction

model construction entails an attept to translate the ~~program~~ problem into mathematical relationship. If the resulting model fit one of the standard mathematical tool, such as linear programming, we can usually reach a solution by using available algorithms.

Alternatively, if the mathematical relationship are too complex to allow determination of an analytic soln. the OR team may opt to simplify the model and use a heuristic approach. or they may be considered the use of simulation. If appropriate. In some case mathematical and simulation and Heuristic model may be combined to solve the problem

Model Solution -

This is the simplest phase because it use well-defined optimizing algorithms. An important aspect of model soln. phase is sensitivity analysis. It deals with obtaining additional information about behaviour of the optimum soln. when the model under goes some parameter change This is needed when parameter estimation is not get estimated properly. It is important to study the behaviour of the optimum solution in the neighbourhood of estimated parameter.

Model Validity.

Check whether or not the proposed model does what it's to do, that is predict adequately the behaviour of the system under study? Initially, the OR team should be convinced that the model output does not includes surprises. In other words does the solution make sense? Are the result intuitively acceptable? On formal side a common method for checking the validity of model is to compare its output with historical output data. this model is valid if, under similar input condition, it reasonably duplicates the past performance.

Generally however their is no assurance that future performance will continue to duplicate past behaviour. Also because the model is usually based on careful examination of past data. the proposed comparision is usually favourable. If a proposed represent new system. no historical data would be available.

Implementation of model.

Implementation of the solution of a validate model involves the translation of result into understandable operating instruction to be issued to the people who will administer the recommended system. The burden of this task rely on OR team.

Scope of Operation Research.

i) financial planning and budgeting—

It has become necessary for all government to carefully prepare for nations economics development in light of the recent financial crisis. Operational research method can be effectively used.

OR aids in choosing the optimal replacement plans. as well as helping the nation's economic development in light of recent financial crisis. as well as helping to identify the company's profit strategy. maximum per capita income, with minimum resource etc.

Both short-term issue with cash management and long term issue with capital investment can benifit from operation research. in financial management.

ii) Data Analytics—

You want to develop better methods to lower the rate of customer turnover because you have a lot of data on customer satisfaction. You apply operation research method to identify the crucial variables and predictive analysis to generate knowledge that aids in creation of plan.

iii) Industry—

If the sectors management makes decision based on his experience and the day comes when he gets retired. the industry will lose a lot of money. Hiring a young OR expert

In management can immediately make up for this devaut-ting loss.

Therefore OR aids the industrial director in choosing the optimal allocation of numerous limited resource such as workers, machines, materials. etc.

iv) Production –

one way in which production managers can use OR –

- To determine the quantity & size of product manufactured
- the production machinery's scheduling and sequence
- Selecting, scouting and preparing factory assembly
- Determining the appropriate factory size and location
- Creating projections for all inventory items. and determining optimal order and replenishment amount.

v) Research & Development –

Organisational challanges arises from combining innovation generating activities to reflect obstacles to delivering promised result. Such challanges are not unique to operation research but instead affect the entity of process

OR is applicable in following ways –

- organising the launch of new product
- management of R & D effort.
- locating potential research and development centre
- Choosing which project to work on and creating cost estimates for them.

4) Limitation of Operation Research.

OR has some limitation however, these are related to the problem of model building and the time & money factors involved in application rather than its practical utility.

i) Magnitude of Computation

Operation Research try to find out optimal solution taking into account all the factor. These factors are enormous & expressing them in quantity and establishing relationship among these require voluminous calculation which can be handled by computers.

ii) Non quantifiable factors.

OR provides solution only when all elements related to a problem can be quantified. All relevant variables are do not lend themselves to quantification. Factors which cant be quantified find no place in OR study. Models in OR do not take into accocunt qualitative factors or emotional factors which may be quite important.

iii) Distance between user and analyst.

OR being specialist's job require a mathematicians or statistic -ian, who might not be aware of business problem. Similary a manager fails to understand complex working of OR. Thus there is gap between management itself may offer a lot of inconvenience and resistance

iv) Time & money cost :-

When basic data are subject to frequent change, incorporating them with OR model is costly proportion. Moreover, a fairly good solution at present may be more desirable than a perfect OR solution available after some time. The computational time increase depending upon the size of problem and accuracy of result desired.

v) Implementation-

Implementation of any decision is a delicate task. It must take into account the complexity of Human relations and behaviours. Some times, resistance is offered due to psycological factors which may not have any bearing on problem as well as its solution.

...ication of operation research.

i) Allocation and distribution in projects.

a) optimal allocation of Resource such as men materi-al machines, time & money to project.

b) Determination and Deployment of proper workforce

c) Project scheduling, monitoring and control.

ii) Production and facilities planning

a) factory size and location decision.

b) estimation of number facilities required.

c) Preparation of forecast for various inventory items and computation of economic order quantities and reorder level.

d) Scheduling and sequencing production runs by proper allocation of machine

e) transportation loading and unloading.

f) warehouse location decision.

g) Maintenance policy decisions.

iii) Programmes Decisions -

a) What, when & how to purchase to minimize procurement cost.

b) bidding and replacement policies.

iv) Marketing -

a) advertising budget allocation.

b) product introducing timing.

c) selection of advertising media

d) selection of product mix

v) finance -

a) capital requirement, cash flow Analysis.

b) credit policies, credit risk etc.

c) investment decision

d) profit plan for the company.

vi) Research & Development -

a) Product introduction planning

b) control of R&D project

c) selecting projects and their budget.