Operations Research

Marwadi University

Department of Information and Communication Technology

Unit 1:
Introduction to Operations Research

Optimization Technique (01CT0501)

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Operations Research

- Science of rational **decision-making** and the study, design and integration of complex situations and systems with the **goal of predicting system behaviour** and improving or **optimizing** system performance.
- O.R. is a systematic and Analytical Approach to decision making and problem solving
- It is a branch of **applied mathematics** in the domain of **Computer Science**
- It is typically concerned in determining **MAXIMUM** (profit, sale, output, yield, efficiency, accuracy) and **MINIMUM** (loss, risk, cost, time) for some objective function with given constraints.

Operations Research – An Example

- P1, P2 covers the topics related to DBMS, NLP, OS
- P3, P4 covers topics related to DBMS, Recommendation System, Optimization Technique

- R1, R2 knows the subjects DBMS, OS

	p_1	p_2	p_3	p_4
r_1	2	2	1	1
r_2	2	2	1	1

- What would be the **fair assignment** for reviewing the papers such that each reviewer can review maximum 2 papers.

Operations Research – History

- This field is in existence since 1930's.
- Initially, it came into existence for the military services requirements of World War II.
- Because of the war efforts, there was an urgent need of allocation of the scarce resources to the military operations and military activities.
- So, British and then U.S. militant management called upon a team of scientists to apply a scientific approach to deal with this situation strategically.

Operations Research – History

- Since then, O.R. has expanded into the field used in industries like petrochemical, aeronautical, finance, logistics, private sector as well as public sector.
- Now it has become an area of research in the field of academics as well as industrial research.
- **Operations Research Society of India** has been established in 1957 and is affiliated to International Federation of Operational Research Societies.
- The headquarter is located in KOLKATA and at present is operating in 12 different centres in India, including Ahmedabad.

Stages of development of O.R.

Step I: Observe the problem environment

Step II: Analyze and define the problem

Step III: Develop a model

Step IV: Select appropriate data input

Step V: Provide a solution and test its reasonableness

Step VI: Implement the solution

Step 1

Observe the problem environment

Process Activities:

Site visits, Conferences, Observations, research

Process Output

Sufficient information and support to proceed

Step 2

Analyze and define the problem

Process Activities:

Define: Use, Objectives, limitations

Process Output

Clear grasp of need for and nature of solution requested

Step 3

Develop a Model

Process Activities:

Define interrelationships, Formulate equations, Use known O.R. Model , Search alternate Model

Process Output

Models that works under stated environmental constraints

Step 4

Select Appropriate Data Inputs

Process Activities:

Analyze: internal-external data, facts, Collect options, Use computer data banks

Process Output

Sufficient inputs to operate and test model

Step 5

Provide a solution and test its reasonableness

Process Activities:

Test the model, find limitations, update the model

Process Output

Solution(s) that support current organizational goals

Step 6

Implement the solution

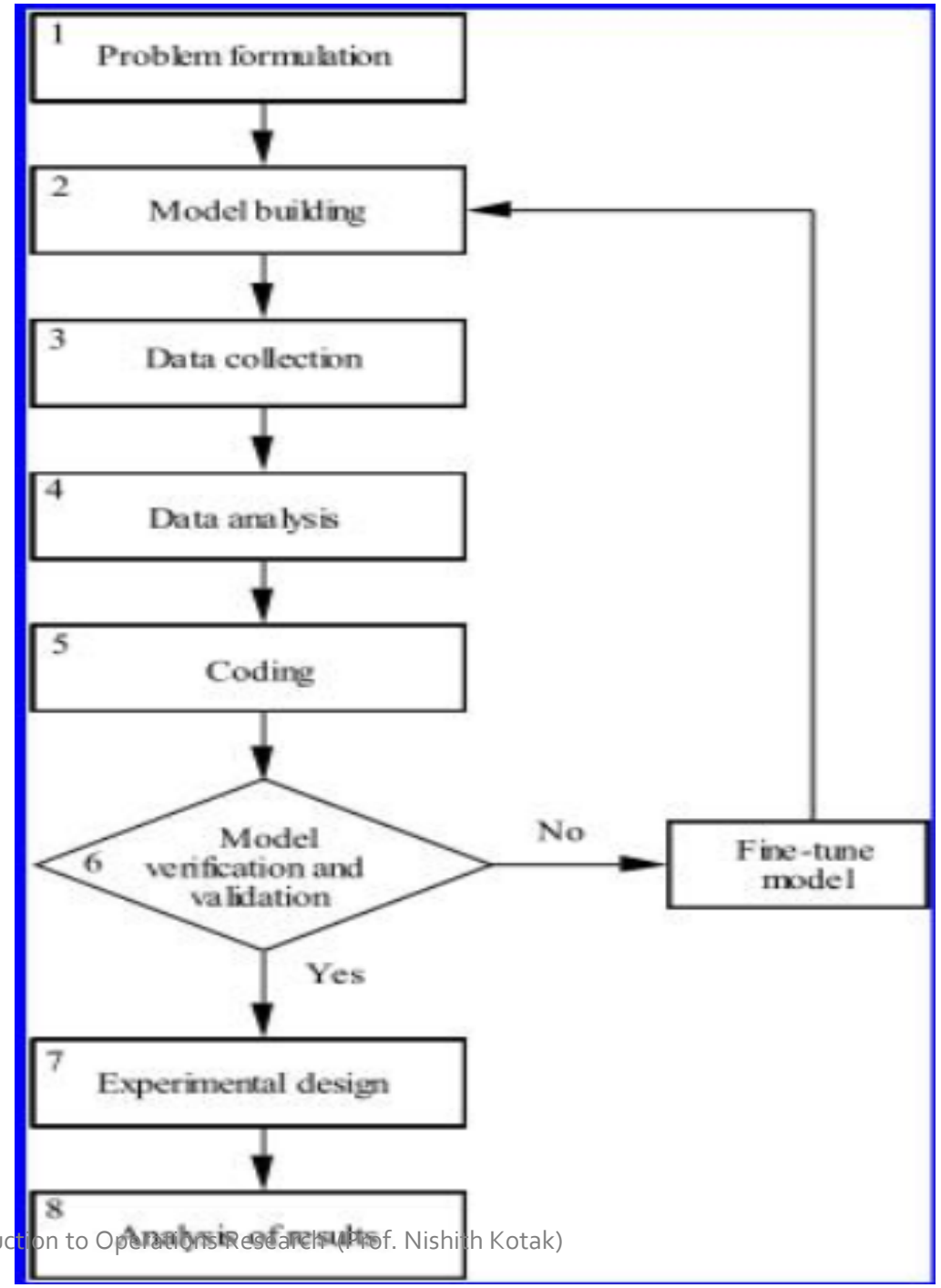
Process Activities:

Resolve behavioural issues, Sell the idea, Give explanations, Management involvement

Process Output

Improved working and Management support for longer run operation of model

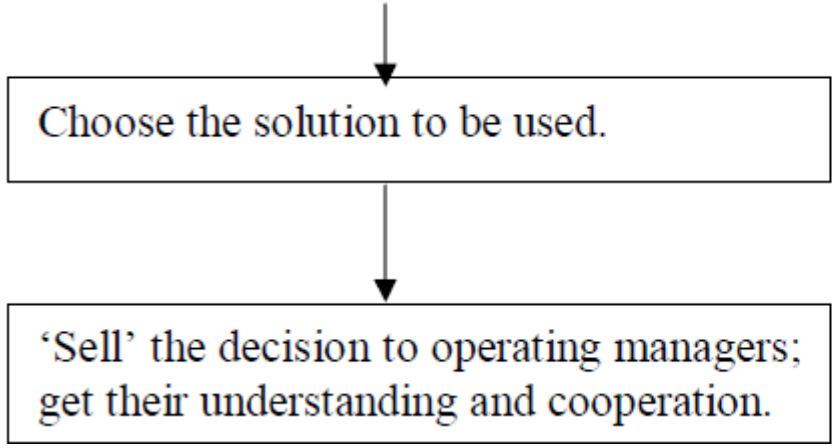
Flowcharts for Steps involved in O.R.



Role of O.R. Specialist in development of solution

STEPS IN PROBLEM RECOGNITION, FORMULATION AND SOLUTION	INVOLVEMENT: O.R. SPECIALIST or MANAGER
Recognize from organizational symptoms that a problem exists.	Manager
Decide what variables are involved; state the problem in quantitative relationships among the variables.	Manager and O.R. Specialist
Investigate methods for solving the problems as stated above; determine appropriate quantitative tools to be used.	O.R. Specialist
Attempt solutions to the problems; find various solutions; state assumptions underlying these solutions; test alternative solutions.	O.R. Specialist
Determine which solution is most effective because of practical constraints within the organization; decide what the solution means for the organization.	Manager and O.R. Specialist

Role of O.R. Specialist in development of solution



Manager

Manager and O.R. Specialist

Examples of O.R.

- Rescheduling the Aircrafts in response to groundings and delay
- Planning Production for PCB assembly
- Controlling various machines time-to-time in production house
- Sales Forecasting
- Time Table Management
- Selection of advertising media and terms of cost and time factor
- Selection of appropriate salesman in a particular area and thereby selecting the salary for him
- Developing routes for proper delivery
- Selection of proper candidate in a company or promotion of a personnel in a company meeting criteria

Scope of O.R.


Finance
Budgeting
and
investments
Purchasing
Procurement
and
Exploration
Production
Management
Marketing
Management
Personal
Management

Scope of O.R.


Research and Development
National Planning and Budgeting
Defence Services
Agriculture and Irrigation
Education and Training

Broad Classification of O.R.

- **O.R. applies three basic methods :**

1. **Simulation Methods**
2. **Optimization Methods**
3. **Data Analysis Methods**

Simulation Methods

It gives the ability to conduct sensitive study to

1. **Search for improvements**
2. **Test the improvement ideas**

Through the simulation models

Optimization Methods

Enables decision makers to identify and locate the best choice where numerous feasible choices are available (keeping in mind the constraints).

Data-Analysis Methods

Locate the pattern of the data and interconnection of the datasets.
Analyse the data to make the solutions