

# Chapter 1

## *Introduction*

### *to*

## *Operations Research*

#### **R. 1. 1. (Historical Background)**

Early origins:

- 300 BC Euclid: How to find the shortest distance between a point and a line.
- 1629 AD Fermat: He developed a method for finding maxima and minima and thus discovered differential calculus.

1917: First optimisation book published: Harris Handcock: *Theory of Maxima and Minima*.

World War II: Modern Operations Research developed during the war:

- Multidisciplinary teams of scientists were assembled as special units within the armed forces. For example, such teams existed in Britain by 1941 in each of the three wings of the Armed Forces.
- Typical projects: Radar deployment policies, aircraft fire control, fleet convoy sizing, and detection of enemy submarines.
- Because of military nature of the applications, the science became known as “Operational Research” in the United Kingdom and as “Operations Research” elsewhere.

After the War:

- Many of the war scientists turned their attention toward the application of the OR techniques to civilian problems.
- Large companies were the first to use OR methods, notably the petroleum industry (linear optimisation for production scheduling).
- Initially, only large companies could afford the research. Later, researchers were able to categorise and standardise types of problems (inventory, allocation, replacement, scheduling, etc.) and smaller companies gained access to OR techniques.
- Important factor in the success of OR has been the current development in electronic computing technology.
- In 1952 the Operations Research Society of America (ORSA) was founded in the United States giving OR a unique disciplinary identity.  
In 1953 The Institute for Management Sciences (TIMS) was founded in the United States. The two groups merged in mid-90's to form the Institute for Operations Research and Management Science (INFORMS).

### **R. 1. 2. (A Definition of OR)**

There are various definitions of OR and its scope. We confine ourselves to the following:

“Operational research is the application of the methods of science to complex problems arising in the direction and 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 measurements of factors such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies and controls. The purpose is to help management determine its policy and actions scientifically.”

*The Operational Research Society of Great Britain*

### **R. 1. 3. (OR Methodology)**

A possible procedure:

- Step 1: Define the problem
- Step 2: Observe the system.
- Step 3: Formulate a mathematical model.
- Step 4: Verify the model.
- Step 5: Select an alternative.
- Step 6: Present the results and conclusions.
- Step 7: Implement and evaluate.

### **R. 1. 4. (Some Applications)**

- Stock and bond portfolio selection.
- Manufacturing.
- Chemical plant (blending)
- Fuel selection for fossil power plant
- Scheduling and queuing
- Inventory management
- Site location
- Forecasting.

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