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INTRODUCTION

1.1 INTRODUCTION

Engineers are planners and builders. They are also problem solvers, managers, and decision makers. Engineering economics touches each of these activities. Plans and productions must be financed. Much of the management function is directed toward economic objectives and is monitored by economic measures. Engineering economics is closely aligned with conventional microeconomics. It is devoted to problem solving and decision making at the operations level. It can lead to suboptimization a condition in which a solution satisfies tactical objectives at the expense of strategic effectiveness but careful attention to the collection and analysis of data minimizes the danger. Evaluations rely mainly on mathematical models and cost data, but judgement and experience are pivotal inputs.

1.2 ENGINEERING DECISION MAKERS

The following general questions are representative of those that an engineer might encounter:

- Which one of several competing engineering designs should be selected?
- Should the machine now in use be replaced with a new one?
- With limited capital available, which investment alternative should be funded?
- Would it be preferable to pursue a safer conservative course of action or to follow a riskier one that offers higher potential returns?
- How many units of production have to be sold before profit can be made? This area is commonly called break-even analysis.
- Among several proposals for funding that yield substantially equivalent worth while results but have different cash flow patterns, which is preferable.
- Are the benefits expected from a public service project large enough to make its implementation costs acceptable?

Two characteristics of the questions above should be apparent. First, each deals with a choice among alternative; second, involve economic considerations. These considerations are embodied in the decision-making role of engineering economists to

1. Identify alternative uses for limited resources and obtain appropriate data
2. Analyzes the data to determine the preferred alternative.

The breadth of problems, depth of analysis, and scope of application that a practicing engineer encounters very widely. In the following typical situations economic decisions are required.

Should a manufacturing plant in its own production facility, knowing that major investment will be needed in new equipment and that expensive training procedures will have to be implemented, or should the plant subcontract to an outside vendor? A university is planning a new foot ball stadium. Should the stadium be constructed now with a planned seating capacity of 80,000, or should it first be constructed with 65,000 seats with a planned end-zone enclosure to bring it to 80,000 seats in 5 years? Projected attendance revenues, expected increases in labour costs in 5 years, and potential stadium use problems during expansion are all factors that need to be considered. A manufacturing engineer is planning a high-speed production line that will use automated transfer mechanisms to move and position products from one automated work station to the next. More complex work stations will allow more operations to be completed at a work station at the expense of lower production rates per hour. However, such a situation could have the advantage of allowing fewer expensive transfer mechanisms. Given forecasts of products demand for the next 5 years should the engineer plan for a one-shift operation with a certain number of transfer mechanisms or for a two-shift operation with fewer transfer mechanisms? A decision is simply the selection from two or more course of action, whether it takes place in construction or production operations, services or manufacturing industries, private or public agencies. Most major decisions, even personal ones, have economic overtones. This consistent usage makes the subject of engineering economics especially challenging and rewarding.

1.3 ENGINEERING AND ECONOMICS

Engineers were mainly concerned with the design, construction and operation of machines, structures and processes. They gave less attention to the resources, human and physical that produced the final product. Many factors have since contributed to an expansion of engineering responsibilities and concerns. Engineers are now expected not only to generate novel technological solution but also to make skillful financial analyses of the effects of implementation. In today's close and tangled relations among industry, the public and government, cost and value analysis are expected to be more detailed and inclusive (*e.g.*, worker safety, environmental effects, consumer protection, resource conservation) than ever before. Without these analysis, an entire project can easily become more of a burden than a benefit. Most definitions of engineering suggest that the mission of engineers is to transform the resources of nature for the benefit of the human race. A growing awareness of the finite limits of the earth's resources has added a pressing dimension to engineering evaluations. The focus on scarce resources welds engineering to economics. Scientists are devoted to the discovery and explanation of nature's laws. Engineers work with scientists and translate the revelations to practical applications. The "laws" of economics are not as precise as those of physics, but their obvious applications to the production and utilization of scarce resources ensures increasing attention from engineers.

1.4 PRINCIPLES OF ENGINEERING ECONOMY

The development, study and application of any methodology must begin with a basic foundation. The foundation for engineering economy is a set of principles, on fundamental concepts, that provide a sound basics for development of the methodology. The principles must be adhered to and in most instances are also integral to decision making. The following are seven principles of Engineering Economics.

1. The choice (decision) is among alternatives. The feasible alternatives need to be identified and then defined for subsequent analysis.
2. Only the differences in expected future outcomes among the alternatives are relevant to their comparison and should be considered in the decision.
3. The prospective outcomes of the feasible alternatives, economic and other, should be consistently developed from a defined view point (perspective).
4. Using a common unit of measurement to enumerate as many of the prospective outcomes as possible will make easier the analysis and comparison of the feasible alternatives.
5. Selection of a preferred alternative (decision making) requires the use of a criterion (on criteria). The decision process should consider the outcomes enumerated in the monetary unit, and those expressed in some other unit of measurement on made explicit in a descriptive manner.
6. Uncertainty is inherent in projecting (on estimating) the future outcomes of the feasible alternatives and should be recognized in their analysis and comparison.
7. Improved decision making results from an adaptive process; to the extent practicable, initial projected outcomes of the selected alternative and actual results achieved should be subsequently compared.

1.5 PROBLEM SOLVING AND DECISION MAKING

An engineering economist draws upon the accumulated knowledge of engineering and economics to fashion and employ tools to identify a preferred course of action. There is still considerable debate about their theoretical bases and how they should be used. There are many aspects to consider and many ways to consider them.

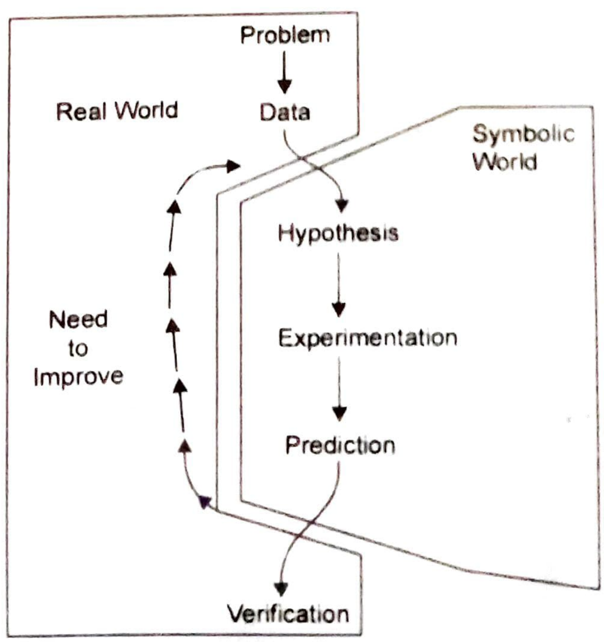

Fig. 1.1 Problem solving process.

The fundamental approach to economic problem solving is to elaborate on the time-honored scientific method. The method is anchored in two worlds: the real, everyday working world and the abstract, scientifically oriented world as shown in Fig. 1.1. Problems in engineering and managerial economy originate in the real world of economic planning, management, and control. The problem is confined and clarified by data from the real world. This information is combined with scientific principles supplied by the analyst to formulate a hypothesis is symbolic terms. By manipulating and experimenting with the abstractions of the real world, the analyst can simulate multiple configurations of reality that otherwise would be too costly on too inconvenient to investigate. From this activity a prediction usually emerges.

The predicted behaviour is converted back to reality for testing in the form of hardware designs, or commands. If it is valid, the problem is solved. If not, the cycle is repeated with the added information that the previous approach was unsuccessful.

1.10 LAW OF SUPPLY AND DEMAND

An interesting aspect of the economy is that the demand and supply of a product are interdependent and they are sensitive with respect to the price of product. The interrelationships between them are shown in Fig. 1.4.

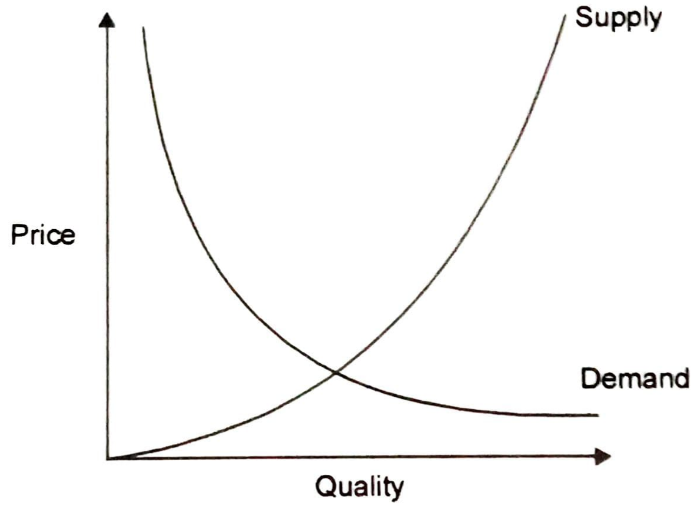

Fig. 1.4 Demand and supply curve.

It is clear that from Fig. 1.4, when there is a decrease in the price of a product, the demand for the product increases and its supply decreases. When lowering the price of the product makes the producers restrain from releasing more quantities of the product in the market. Hence, the supply of the product is decreased. The point of intersection of the supply curve and the demand curve is known as the equilibrium point. The quantity of supply is equal to the quantity of demand. This point is called equilibrium point.

Factors Influencing Demand

The shape of the demand curve is influenced by the following factors:

- Income of the people
- Prices of related goods
- Tastes of customers.

If the income level of the people increases, automatically their purchasing power will naturally improve. This would definitely shift the demand curve to the north-east direction as shown in Fig. 1.4. For example, the price of computer sets is lowered drastically its demand would naturally go up. As a result, the demand for its associated product, namely as shown in Fig. 1.4. For example, the price of computer sets is lowered drastically its demand would naturally go up. As a result, the demand for its associated product, namely printers, CD, floppy, CD writers would also increase. Hence, the prices of related goods influences the demand of a product.

Over a period of time, the preference of the people for a particular product may increase and also affect its demand.

Factors Influencing Supply

The shape of the supply curve is affected by the following factors:

- Costs of the inputs
- Technology
- Weather
- Prices of related goods

If the cost of inputs increases, naturally the cost of the products will go up. In this situation the product profit margin per unit will be less. The producer's will then reduce the production quality which in turn will affect the supply of the product. For example, if the prices of fertilizers and cost of labour are increased significantly, in agriculture, the profit margin per bag of paddy will be reduced. Then, the farmers will reduce the area of cultivation and hence, the quality of supply of paddy will be reduced at the prevailing prices of the paddy.

If there is an advancement in technology used in the manufacture of the product in the long run, there will be a reduction in the production cost per unit. Then it will enable greater profit margin per unit at the price of the product. Hence, the producer will be tempted to supply more products to the market. Weather also has a direct bearing on the supply of products. For example, during winter woollen products will have demand more. This means the prices of woollen goods will be increased in winter. So, naturally, the manufacturer will supply more volume of woollen goods during winter.