Managerial and Engineering Economy

ECONOMIC DECISION-MAKING

THIRD EDITION

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Preface

MANAGERIAL AND ENGINEERING ECONOMY is designed to provide a sound introduction to economic decision-making, that is, selecting the best alternative according to economic criteria. The book is intended for students of engineering, business administration, economics, accounting, and finance. Considering the breadth of the subject, the text also provides fundamentals for students majoring in the sciences, social sciences, or humanities and, as a study and reference tool, for executives in all functional areas. The only prerequisites are basic algebra and the ability to think quantitatively.

The author has consistently aimed to show how this discipline establishes a guide for every course of action in an industrial enterprise. Economic decision-making also provides the basis of communication—the common ground—between all sectors of the organization: engineering, planning, marketing, finance, production, and administration.

Several significant improvements have been made in the Third Edition. This edition uses the Standard Functional Symbols in all examples and problems. This format, which originated with an *ad hoc* committee of the Engineering Economy Division of the American Society for Engineering Education, was adopted by the Society and appeared in the *Engineering Economist,* Volume 14, Number 2. This publication gives two sets of standards: mnemonic and functional. Because the mnemonic set that was adopted was not truly mnemonic and opened the way for error, it has since been discarded. Meanwhile, the existence of a clearly understandable set of functional factors led most writers and ANSI, the American National Standards Institute, to adopt the functional set. The Third Edition uses the Functional Symbols as a universal language. Although writers may use functional symbols, it is still a universal practice to describe the factors in the derivations, in the tables, and in the text by the traditional names, as for example: "single-payment compound-amount factor." (See Section 3.12.)

Another improvement in the Third Edition concerns particularly instructors teaching a basic, one-term course in Engineering Economy. The limited time available for study, assignments, and class recitations requires the instructor to

decide what material to include in the course and what must be omitted from the text.

In this edition we continue to give a complete coverage of the subject, but here for the first time we indicate to instructors and other users how they can recognize the basic from the extended materials. Certain sections are marked with an asterisk to indicate "supplemental study." All of these supplemental sections occur in the body of the text because that is where they belong. The supplemental material is logically derived from the reasoning in the basic material. It is developed by an intellectual extension of the basic reasoning and does not break the continuity of the student's thinking. Instructors pressed for time in a one-term course can therefore omit the sections marked with an asterisk without loss of continuity, decrease in quality, or sacrifice in the competence they expect in the course. These sections are identified in the "Contents" for the convenient reference of instructors.

Even with the omission of these supplemental sections, instructors may find that they still have more material than they can cover. If time is severely limited, instructors may benefit from a list of the chapters that should be covered:

Chapters 1-8 inclusive, but entirely omitting Continuous Interest Sections 3.18-3.24 and Dual Rates.Sections 8.14-8.20.

Chapter 11 except for Obsolescence Factors Sections 11.13-11.15.

Students who pass the course with a knowledge of these fundamentals can associate with either engineer or manager in this kind of decision-making. If more time is available, after having covered the foregoing basics, instructors may elect any of the other areas—with the possible omission of supplementary sections. They may want to cover part of Chapter 15 Taxes or Chapter 18 Public Economic or Chapter 10 Economic Life. Finally, there is an expanded discussion of the effects of inflation on economic decisions in Section 16.13.

A Solutions Manual for Instructors with solutions to the problems in the text and suggestions on how to use these problems to stimulate class discussions is available.

My sincere thanks go to the students and members of the executives programs who studied with me during the many years of developing this book and who gave constructive ideas and encouragment.

George A. Taylor

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Alternatives

1.1 DECISION-MAKING DEFINED

Economic Decision-Making expresses the primary objective of this book, and the expectation that the subject will be a dynamic and valuable tool to the person who learns to use it. We can demonstrate this immediately by noting the following definition of decision-making.

Competent decision-making is a two-part activity:

1. The generation of all the alternative courses of action that the situation demands.
2. The selection of the best course of action from these alternatives.

This definition disagrees with those definitions which merely limit decision-making to choosing between alternatives X and Y. The reason for our two-part definition is that no manager, given the authority of choosing a course of action, can defend a bad decision by pointing out that he made a mathematically correct choice between two very poor alternatives. It is the decision-maker's job to conceive, create, discover, and develop all possible courses of action that the given situation demands. A decision to approve expenditures for products X or Y always must imply that products Z, X_1, or Y_1 should not be approved. If X is selected, enormous—perhaps fatal—losses can result if Z subsequently proves to be the product that should have been selected.

The manager is called on to provide the "best" solution to a given problem, and thus he must innovate, simply because existing alternatives may be greatly inferior to those which he can create. This, of course, is a large responsibility, and unfortunately one for which few managers have been educated. But whether a manager knows how to innovate or not, he will be responsible as long as he is the designated decision-maker.

If the first phase of decision-making is innovation, then the second is economic discrimination, or (as it is called in this text) economic decision-making. The principles and techniques of this discipline are the subject of this book. Many

decision-makers function without a knowledge of economic decision-making, and this lack invites unbelievable losses—as the reader will observe in the many examples in the text.

It may seem that limiting our subject to economic decision-making eliminates consideration of innovation. While innovation constitutes a different subject and a separate mode of thinking, an understanding of the economic criteria can develop an awareness of other courses of action that might exist or can be devised. This awareness often can put the decision-maker on the track of new alternatives of significant economic potential, and it will certainly make him cautious of merely choosing between two alternatives without considering that other, better choices might exist.

Knowing the criteria by which these alternatives will be selected or rejected is in itself an operational guide to identifying or discovering other courses of action. For example, if product Y is more trouble-free than X (a desirable feature, say, because competent repair service is unavailable) might we develop product Z which is even more reliable, or Y_1 which provides almost the same features as Y or Z at a lower price? This thinking will be guided by economic awareness. Practiced in this manner, the subject becomes a dynamic management tool.

This suggests that we might examine in more depth the responsibilities and great opportunities which exist in the decision-maker's role.

1.2 THE TWO ROLES OF THE EXECUTIVE

Every executive has basically two roles, and many executives perform only one of these.

His first role is to "maintain standards," that is, to see that activities are performed as planned, that costs do not exceed the preset standard cost, that labor performs the job by the preset standard method, that the required labor and material are on hand, that shipments occur on schedule in the right quantity, that planned quality of the product does not deteriorate, and so on. Maintaining present standards is a major task performed by many executives not only with "sleeves rolled up" but often after regular business hours. It is commonly understood that if something can go wrong it will, and so the executive seems continually to be repairing the breaches which develop in business operations. Even with strict adherence to the exception principle, the exceptions are enough to keep an executive busy. The executive's function in this role is like that of a servomechanism, because every dynamic system needs continuous readjustment to make it follow the standard. No one denies that this function demands great effort.

The second role of the executive is to improve the existing standards so that the company can maintain or improve its profits. In this role the executive must generate alternatives. Ideally, he challenges every standard and method in his sphere of responsibility, searches for alternative ones, and adopts them according to economic criteria. This role is vital because any company that is content

only to maintain its existing standards will find itself failing because of competitive pressure. The company that successfully keeps its status quo, while other companies improve their methods and increase their profits, will eventually discover it cannot meet the prices established by its progressive competitors. Many executives, nevertheless, are unprepared to fill this challenging role, and too often their education in economic decision-making is badly neglected or totally lacking. George Terborgh[1] says, "When we consider the advanced techniques now employed in other areas of business management, we may well wonder if equipment policy is not, in general, the most backward sector of all. We are inclined to think it is." We suggest that this statement can be broadened to include the whole area of economic decision-making.

Regardless of how hard an executive works in his role of "maintaining standards," his company can fail and he can fail personally as a manager. Let us not overlook the fact that some executives have worked very diligently, faithfully, and successfully to maintain standards. Some executives indeed have been so preoccupied in this task that there has been no change in standards in their business in many years. (The most successful ones, in this respect, may be out of business.)

What we have said, therefore, is that every manager has two fundamental roles:

1. Maintain the existing standards
2. Create improved standards.

Reflection on the two roles of the manager will lead to the conclusion that everyone, whatever his level or area of authority, ought to function as a decision-maker. To perform these roles he must realize that for every existing course of action under his control there is an alternative course of action which can be economically superior and that it is his responsibility as the manager to search for and discover that alternative. He cannot claim a lack of education in the processes of decision-making as an excuse for his inability to accept and adequately perform that responsibility. On the other hand, the opportunities to perform as this kind of a decision-maker are unlimited and the rewards for competent performance are high.

1.3 THE MANAGER'S ROLE IN THE FUNCTIONAL AREAS OF THE COMPANY

Modern management principles make the operating managers and administrators responsible for identifying the areas that should be improved and for seeing that the improvement is made. This replaces the concept that the only function of the operating manager is to control his area (and very likely to resist changes, since changes disturb his control).

Modern management makes the staff departments responsible to the operating

[1]George Terborgh, *Dynamic Equipment Policy* (New York: McGraw-Hill, 1949), p. 216.