

*Capital Investment
Decision Analysis
for management
and engineering*

John R. Canada — John A. White

Capital Investment Decision Analysis for management and engineering

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Prentice-Hall Inc., Englewood Cliffs, NJ 07632

Library of Congress Cataloging in Publication Data

Canada, John R

Capital investment decision analysis for management and engineering.

Edition of 1971 published under title: Intermediate economic analysis for management and engineering.

Bibliography: p.

Includes index.

1. Capital investments--Evaluation. I. White, John A., 1939- joint author. II. Title.

HG4028.C4C3 1980 658.1'527 79-21228

ISBN 0-13-113555-4

Editorial/production supervision and interior design by STEVEN BOBKER
Manufacturing buyer: GORDON OSBOURNE

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Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

Prentice-Hall International, Inc., *London*
Prentice-Hall of Australia Pty. Limited, *Sydney*
Prentice-Hall of Canada, Ltd., *Toronto*
Prentice-Hall of India Private Limited, *New Delhi*
Prentice-Hall of Japan, Inc., *Tokyo*
Prentice-Hall of Southeast Asia Pte. Ltd., *Singapore*
Whitehall Books Limited, *Wellington, New Zealand*

preface

This book is an extensive revision of *Intermediate Economic Analysis for Management and Engineering*, published by Prentice-Hall in 1971. It continues as a text and reference on capital project economic evaluation that is more concise and yet more advanced than the traditional applied works and that contains abundant example problems and solutions.

In addition to concisely covering the basic principles of interest computations and basic analysis methods, this book extensively treats techniques for the quantitative analysis of investment problems involving risk and uncertainty. Almost all of these techniques are candidates for straightforward and widespread application in practice, while some are presented in the belief that they will prove valuable as progressive analysts and management personnel work to develop their usefulness. This book is significantly more complete than its predecessor because of the inclusion of additional quantitative techniques, particularly mathematical programming for handling capital budgeting problems, and sensitivity and risk analysis techniques.

The book is intended primarily for advanced undergraduate or graduate study and for students of all disciplines, particularly business and engineering. The concise explanatory features also make the book suitable as a reference in industry. It contains a rather succinct summary of basic capital project evaluation techniques (Part I), and it emphasizes more advanced techniques, concepts, and analysis procedures (Parts II and III).

For the use of Part I, only a knowledge of first year algebra is required, while for much of Parts II and III it is assumed that the student understands the basic analysis procedures of Part I and has a fair knowledge of elementary probability. Some fundamental probability concepts are explained in the text, but those who need further background will find that the first half of most probability and statistics texts will provide adequate review material. Com-

plete understanding of the application of some specialized quantitative techniques to investment economic analyses will be facilitated by prior exposure to the theory underlying those techniques. For an abbreviated first course on the fundamentals of engineering or project economy, Part I can serve as an applications-oriented text which contains essentially the same breadth of coverage as traditional undergraduate texts. The integration of project economic analysis into the larger picture of capital budgeting within the firm is accomplished in Chapter 10, which contains an appendix on procedures and forms used in practice.

For a course in economic evaluation of alternative projects at the advanced undergraduate or initial graduate level, Part I can be used for review purposes as needed, with Parts II and III providing the primary study material. Since the chapters in Parts II and III are largely independent of one another, one can include or delete chapters according to the needs of individuals or classes.

Chapter 11 introduces risk and uncertainty concepts with some emphasis on estimating. Chapter 12 illustrates a wide range of tabular and graphical means for exploring sensitivity. Chapters 13 and 14 include techniques for considering variability of outcomes, particularly when probabilities can be estimated. Chapter 15 provides a rather detailed explanation of decision techniques utilizing Bayesian statistics; Chapter 16 focuses on the use of decision tree concepts as a means of taking into account future outcomes, alternatives, and decisions in determining the best initial choice. Chapter 17 presents optimization models for replacing assets that either deteriorate gradually or fail suddenly. Chapter 18 provides useful concepts and solution techniques for applying mathematical programming to capital budgeting analyses involving interrelated sets of alternatives. Chapter 19 illustrates simple quantitative means for weighting objectives and nonmonetary factors.

Innumerable persons—friends, colleagues, and helpers—have contributed to the development of this work, so complete acknowledgment is not possible. Once again, the preparation of this work was made much more tolerable than would have otherwise been possible by the extremely competent secretarial services of Mrs. Martha Jackson and Mrs. Vicki DeLoach. Our wives, Wanda and Mary Lib, helped by providing encouragement and (usually) good working conditions. Dr. Jack Turvaville of Tennessee Technological University and Mr. Nathan Wolf of the International Business Machines Corporation supplied valuable additions to the book. To all these, as well as to the authors and publishers providing reprint permissions, and to many others unnamed, we wish to express our gratitude.

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John A. White

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PART

1

*Basic
Capital Project
Evaluation
Techniques*

Chapter

1

introduction and cost concepts

Project economic analysis involves techniques for comparing and deciding between alternatives on the basis of monetary or economic desirability. With the increasing complexity of our industrial technology, economic decision-making is becoming more difficult and at the same time more critical. Economic analyses serve to quantify differences between alternatives and reduce them to bases which provide for ease of project comparison. The importance of use of these methods varies with alternatives under consideration. In general, the use of these techniques is vitally important, for there is much to be saved or lost by virtue of the particular alternative chosen in usual project investment decisions. Indeed, project investment decisions are critically important factors in determining the success or failure of a firm.