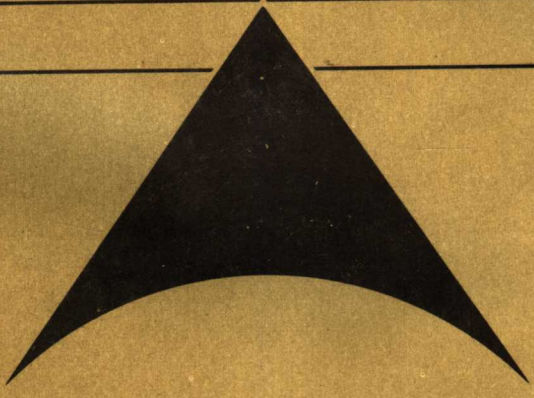
THE VNR CONCISE GUIDE TO MANAGEMENT DECISION MAKING

EDITED BY CARL HEYEL



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VNR CONCISE MANAGEMENT SERIES

Edited by

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Introduction

The essence of *management* decision making, as distinguished from the professional and technical decisions that must be made in the operations areas of an enterprise, is that it concentrates on the *what* rather than the *how*. And despite the complexity in operations brought about by burgeoning technology calling for ever greater specialized training and skills, the fact remains that the *how* presents no particular problem to management. The requisite skills and physical facilities for operations are always available to any organization with the financial resources to command them.

The *what* to do is another matter. Here one leaves the area of the tangible and the specific, the deployment of known resources within known cost parameters, the predictabilities based on recorded experience and replicatable experiment—and enters the realm of risks and uncertainties, of surmise and conjecture, of choices among non-too-clear alternative, of imprecise costs and often irrational human reactions, and often within shadowy and shifting parameters of competitive ethics and social responsibilities.

In short, one is the realm of *strategy:* one would know how to proceed along any alternative line chosen, if only one knew for sure which alternative to choose.

It is to the question of strategy that this volume of the VNR management series is directed. It recognizes that the subjective element will always be present in the decision-making process—"canny business judgment" will never be totally replaced by

mathematical techniques and computer printouts—but it seeks to show how risks can be minimized and profits maximized by the application of proven techniques of quantitative analysis to assess the probable consequences of proposed lines of action.

The presentation has been organized into three major divisions: Part One covers advanced practice in the conventional techniques of financial projections; Part Two reviews the application of mathematical statistics and probability theory to management decision making; and Part Three covers the so-called "newer management sciences." The sequence of the Parts follows the progression of the increasing use of quantitative techniques in management practice.

Two of the chapters in Part One—"Return on Capital" and "New-Product Planning: Profitability Projections"—appear in the companion volume, "The VNR Concise Guide to Financial Management." An editorial decision was made to incur this duplication in order to make each volume logically complete. However, with respect to return on capital, Appendix B in Part Three offers, in addition, a case example on linear programming applied to return-on-capital analysis.

Contents

Part One

Conventional Decision-Making Processes— Advanced Practice

1

Return on Capital

Rate of return on capital, also referred to as "rate of return on investment," is widely used to appraise the effectiveness of management performance, to select the contents of an investment portfolio, and to make decisions regarding new product development and acquisition of plant and equipment. Unfortunately, the term means different things to different people.

DEFINITION

Return on capital is the relationship, usually expressed as a ratio or percentage, between the income (or "profit" or "interest") from an enterprise or undertaking and the related investment or capital commitment.

HISTORY

While ratios between interest and principal have been computed as long as man has loaned money (return on capital consciousness is particularly evident in discussions of usury and "just price" in the Middle Ages), modern applications of this concept may be divided into three historical periods. The first of these periods used the ratio between the income as displayed on the contemporary income statement and divided it by the assets or equity as shown on the balance sheet. This computation developed in the nineteenth century, predominated in security analysis during the first half of the twentieth century, and may still be seen in connec-

tion with regulation of public utilities and analyses made in connection with the purchase and sale of shares of common stock. It is referred to here as the *mercantile rate of return.*

A second approach to capital budgeting reflects the time preference concepts of the bond and money markets. It was not until 1951—partly as a result of trail-breaking books by Dean[1] and the Lutzes[2] that were published in that year—that the method began to be used by financial management in connection with capital budgeting decisions (decisions involving the long-term commitment of capital). For capital budgeting decisions involving bonds and bank loans, the "arithmetic" of discounted cash flow computations and present value computations had been in use centuries earlier. But the attempt to apply the same kind of arithmetic that had been used for fixed-obligation bonds to the wider class of problems involving uncertain cash flows may be identified with the two decades following the publication of the Dean and Lutz books. During the fifties, the use of this approach to capital budgeting was more common in business literature than in the corporate board room, but the method became increasingly popular during the sixties, and is widespread in the seventies. It is referred to here as the *industrial rate of return.*

Over the years, a technique widely used has been the estimation of the time that would elapse before the cash inflows (or the reduction in outflows) resulting from an initial outlay of cash will equal that outlay. This is known as the *pay-back period*, or "pay-out" or "pay-in" period. While not strictly speaking a return-on-capital computation, the reciprocal of the pay-back period will often be an excellent approximation to the rate of return on capital computed by the industrial method, and this is considered later in the discussion of the various methods.

Since 1959, there has been a trend toward a third approach to the solution of capital budgeting problems by the use of linear programming techniques. While this approach does not yet seem to have played a major role in actual capital budgeting decisions, it is certain to do so in connection with large industrial projects

[1] Dean, Joel, "Capital Budgeting," New York, Columbia University Press, 1951.
[2] Lutz, Friedrick and Vera, "The Theory of Investment of the Firm," Princeton, N.J., Princeton University Press, 1951.

and military and space procurement expenditures. The linear programming approach selects the best projects and the best courses of action in terms of some stated objective (say to maximize equity at some later date). While it does not usually involve a direct computation of return on capital, it does permit the capital analyst to detect the binding constraints or bottlenecks to his maximization efforts, and it may thereby permit an indirect computation of a "quasi-" return on capital.

The following paragraphs compare techniques widely used today.

MERCANTILE RATE OF RETURN

The mercantile rate of return is the ratio (expressed in percentage form) between some figure appearing on the contemporary income statement and some figure appearing on the contemporary balance sheet. For illustrative purposes, a simplified income statement for a hypothetical company for the year ending December 31, 1978, and the related balance sheets at the beginning and end of the year are presented in Exhibits I and II respectively. Referring to the figures given there, the mercantile rate might be computed as follows:

$$\text{Rate of Return} = \frac{\text{Income}}{\text{Average Assets}} \times 100$$

$$= \frac{1{,}330}{(4{,}982 + 6{,}312)/2} \times 100$$

$$= 24\%.$$

This mercantile method of computing rate of return on capital has also been referred to as the "accountant's method" (a lamentable libel on a proud profession!) and the "financial-statement method."

Assets are chosen as the base when it is desired to measure the performance of management in using the total amount of property entrusted to its control. Thus, for internal management purposes and from the point of view of the entity as a whole, the important

EXHIBIT I
MERCANTILE ACCOUNTING
INCOME STATEMENT
Year Ending December 31, 1978

Revenues		$4,200
Less: Cost of sales	$2,500	
Depreciation	370	2,870
INCOME		1,330

EXHIBIT II
MERCANTILE ACCOUNTING
BALANCE SHEET
December 31

	1978	*1977*
Cash	$1,000	$1,000
Receivables	4,200	
Inventory		2,500
Equipment	1,852	1,852
Accumulated depreciation	(740)	(370)
ASSETS	6,312	4,982
Contributed capital	5,352	5,352
Retained income (loss)	960	(370)
EQUITY	6,312	4,982

thing may be the effectiveness with which management makes use of the total assets of the company. In contrast, stockholders' equity may be the base of the computation when appraising not only the overall use of the assets, but also the extent to which financing methods were advantageous from the point of view of the stockholders.

The two approaches may be distinguished by the terms "return on assets" and "return," or "yield," on "equity."

To illustrate the distinction, suppose the corporation had been partly financed by the issue of 10% bonds and that the liabilities and equity section of the balance sheet was as follows:

	12/31/78	12/31/77
Bonds payable	$2,000	$2,000
Contributed capital	3,352	3,352
Retained income	960	(370)
LIABILITIES AND EQUITY	6,312	4,982

Let the concluding part of the income statement be the following:

Income before interest expense	$1,330
Less: Interest expense	200
INCOME	1,130

The computation of return on assets would be identical to the previous computation. It would be the ratio of total income ($1,330) earned from the use of all assets (averaging $5,647) without considering the amounts of that income available for the different types of investors and without considering the extent to which those assets had been financed by particular classes of investors. In contrast, emphasizing the interests of stockholders, it would be necessary to relate the net income available to stockholders with the stockholders' equity, specifically:

$$\text{Return on Equity} = \frac{1{,}130}{(2{,}982 + 4{,}312)/2} \times 100$$

$$= 31\%$$

Trading on the Equity. Return on assets and return on equity may be used to understand the effect of "trading on the equity." Where bondholders are paid a lower rate of return earned on total assets, stockholders will benefit. Stockholders, in effect, will receive the benefit on the extra return earned on the assets financed by bondholders. The following *leverage factor* may be computed to assess the extent to which return on equity is improved over return on assets as a result of trading on the equity:

$$\text{Leverage Factor} = \frac{\text{Rate of Return on Equity}}{\text{Rate of Return on Assets}}$$

$$= \frac{0.31}{0.24} = 1.3$$

Where this leverage factor is greater than 1 (as in the example), the stockholders may have benefited through use of the funds supplied by bondholders at a lower rate of return than that earned on the assets. To determine whether stockholders have really benefited, however, it is further necessary to assess or attempt to weigh the greater risk that may be incurred by the company as a result of the greater fixed obligation imposed by the interest and principal on the bonds.

Some companies use gross assets (that is, assets before deducting the depreciation taken on these assets in prior years) instead of net assets in computing return on assets. Such companies justify their use of gross assets by their desire to prevent the rate of return from rising as the net book value of depreciable assets is reduced by depreciation. Undepreciated cost provides an unchanging base and, so long as annual income is constant, the rate of return is stable.

This viewpoint involves certain preconceptions not only about the stability of future earnings but also about what rate of return ought to be: Should the figure for rate of return be stable from year to year because it is stable or because the accountant expects it to be stable and therefore adopts conventions that make it stable? Some accountants have argued that the relevant investment base should instead be assets net of accumulated depreciation allowances, since it seems inconsistent to compare a profit figure from which depreciation *has* been deducted with an investment figure from which the accumulated depreciation *has not* been deducted. There are also many other variations regarding the rate base and dealing with matters such as whether the assets should include excess or idle assets, assets still in construction, assets financed by short-term sources of credit, etc.

There are also many variations in the income figure employed for the mercantile rate of return. Thus some companies do not deduct taxes because they are anxious to measure those things under the control of management, and they feel that taxes, while somewhat subject to managerial control (tax planning), are more under the control of Congress than of management. There are also variations in practice regarding the inclusion of dividend income, interest income, and "other income" and "other expenses" in computing net income for the rate of return calculation.

Whatever variations exist with regard to the capital base and the return on that capital, certain common features seem to be evident in the mechanics of computation. Thus, most companies attempt to get a "representative" figure for the capital base in the sense that it is the average of the relevant balance sheet magnitude at the beginning and end of the year, or it is a thirteen-point average of the balance sheet magnitude at the beginning of the year and at the end of the following twelve months. Furthermore, most companies "annualize" their income statement figure; thus, net income for two months would be multiplied by $\frac{12}{2}$ to get its annual equivalent.

"Du Pont Analysis" of Return on Capital and Sales. Some companies make use of the "du Pont analysis" of return on capital, named after the company that pioneered in its use. While income and capital determine the rate of return on capital, the du Pont analysis introduces a third factor—sales—that may be used to assist in judging the adequacy of income and capital. Note from Exhibit III that:

$$\frac{\text{Income}}{\text{Capital}} = \frac{\text{Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Capital}}$$

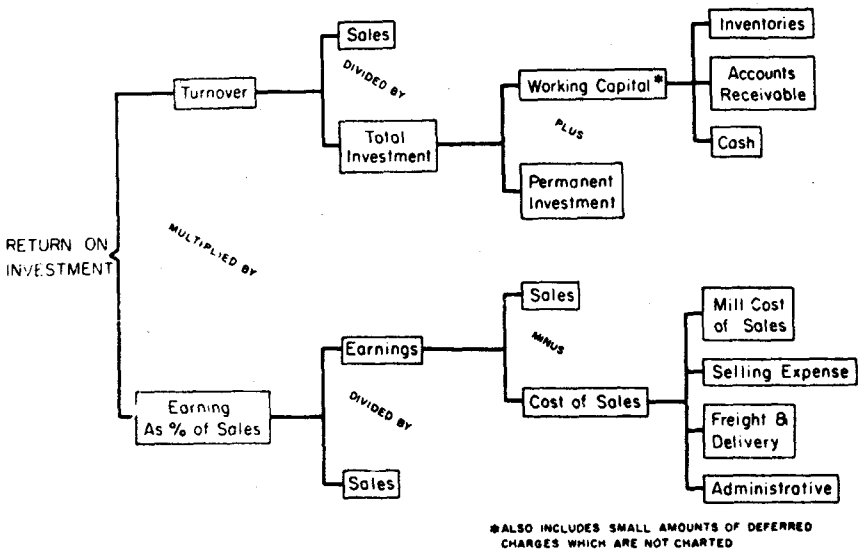
The first factor on the right-hand side of the above equation may be referred to as the *profit margin* and the second as *turnover*. Such a breakdown of return on capital into two factors permits introduction into the analysis of the very important element of sales volume. Further, it permits the breakdown of return on capital to be handled in ratio terms.

If this ratio approach is not taken, then the analysis takes place in terms of total investment and total income and, because of differences in the scale of business, these total dollar figures are not comparable from business to business. By introducing sales, both income and investment are reduced to ratios, and these ratios are somewhat comparable.

To illustrate this du Pont approach, consider the three companies for which certain information is summarized in Exhibit IV. Assuming all three companies are in the same industry, why is it that companies B and C have earned only 1% on capital when

EXHIBIT III
DU PONT ANALYSIS OF RETURN ON CAPITAL

Relationships in the du Pont analysis of return on capital. Arithmetic calculations proceed from right to left.



SOURCE: Watson, Alfred M., "Operations Research and Financial Planning," *Financial Management Series No. 102*, American Management Association, New York, 1952.

company A has earned 20%? Income and investment figures alone shed little light on the question because of disparities in size between company A and the other two companies. Thus it is impossible to say whether B's low rate of return in comparison with A's is attributable to its larger capital or to its lower income. The

EXHIBIT IV
DU PONT ANALYSIS OF RETURN ON CAPITAL

	Company A	*Company B*	*Company C*
1. Sales	$1,000,000	$ 500,000	$10,000,000
2. Income	100,000	50,000	50,000
3. Capital	500,000	5,000,000	5,000,000
4. Income as a % of sales (line 2/line 1, X 100)	10%	10%	0.5%
5. Turnover (line 1/line 3)	2	0.1	2
6. Return on investment (line 4 X line 5)	20%	1%	1%