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Myra A. Swick

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BASIC PRINCIPLES AND METHODS FOR VALUATION OF CAPITAL EXPENDITURES

The author discusses steps which management and the accountant should take in order to make successful capital investment decisions.

Myra A. Swick, CPA
Chicago, Illinois

Capital investment is the life blood of every business. A series of wise capital investments, ably managed, will result in a profitable growth enterprise. On the other hand, lack of capital investments or a series of poor capital investment decisions can spell disaster and bankruptcy to any business. Business survival and success depend upon management maintaining a good batting average in investing capital; but in this modern day, far too many businesses are still making capital disbursements without adequate planning. What is this capital investment that is so important?

Conceptually, there is really no difference between money spent on labor and material as operational expense and money invested in new buildings, equipment, and executive training.

"The distinction between the two expenditures is that we expect to realize a return from outlays on labor and materials within a few months, whereas the benefits from a new building may be forthcoming over a period of many years. More or less arbitrarily we define an operating expenditure as one whose principal benefits are gained within a year, and a capital expenditure as one whose benefits are realized over a period longer than a year."¹

Whether those benefits are being thought of in terms of profits, increased market areas, diversified product lines, or, for that matter, higher salaries for the accounting staff, they will result only from increases in available

cash which result in turn from good financial planning and evaluating. If a capital investment extends over a period of years, it seems any benefits will also extend over a period of years. And any harm done will take its toll over a like time. So whether this decision faces an employer or a client, if the accounting practitioner wants him around beyond the immediate future, he had better be prepared to be of assistance now.

But who, when, where, how, and why?

Who, When, Where

Perhaps "who, when, and where" can be best answered together. Ever since World War II, management has called upon the accountant more and more to help in decision making. In many instances a company's accounting staff is not strong enough to fulfill this role and the certified public accountant must be called upon: of course, the CPA draws his basic information from the client's own accounting department. Just how far the accountant is "entitled" to go has been argued ever since.

At the corporate level, the CPA practitioner's work is often considered done upon submission of the audit report. "If so, it may be that the accounting firm has gone only a quarter of the way," suggests a prominent Wisconsin attorney. In his opinion the corporate president wants continued guidance—"an objective look at the business by an independent and objective outsider"—and he proposes regular "think-tank" sessions for long-range planning for growth, as separate from analysis of routine operations.²



MYRA A. SWICK, CPA, is Controller of Shorr Paper Products in Aurora, Illinois and is also serving as Secretary of AWSCPA.

Miss Swick is a graduate of Loyola University, Chicago. Her public accounting experience was gained on the audit staff of Ernst & Ernst.

In addition to AWSCPA and the Chicago Chapter of ASWA, Miss Swick is a member of AICPA, the Illinois Society of CPAs, and NAA, which she has served for three years as editor of the NAA Chicago Reporter.

It is not likely that the present day accountant will feel that his profession does not have a role in management services. The question that is facing the "thinking accountant" and professional accounting organizations is that role's proper scope. The following thoughts were proposed at an AICPA annual meeting: "Every practicing CPA is qualified through his training and experience to offer management services in some areas. . . . Of course, no one should attempt to furnish a service in an area in which he is not competent."³ But what are "some areas" and how competent is "competent"?

These questions shall be left to the associations. Meanwhile, the accountant has long been connected with capital expenditure decisions in some way. After all, the basic information required for comparisons, no matter what method is used, is found in the financial statements of the company. So at least historically the accountant's role can be justified; while the remaining management "holdouts" argue, the accounting profession can proceed.

How

Proceed. This brings up "how." It also brings the bulk of information in this area which has been presented to the accountant. Many different formulas have been presented and re-presented over the years. However, for the sake of completeness and, hopefully, clarification, five different methods will be shown for "how."

First, though, there must be tentative capital expenditures to work with. Where do these ideas come from? It does not really matter. Anyone from the machine operator to the chairman of the board is competent in this area. But ideas do not implement themselves. Perhaps some of the best and most detailed work in this respect has resulted in the "capital expenditure framework" as developed by Dr. Milton Usry, CPA, of Oklahoma State University. It consists of three foundation components and nine implementation activities.

The foundation components are:

1. Relating plans to objectives. They must not only be possible within the firm, but also compatible with its best interests.
2. Structuring the framework. This is the basis for implementation and must fit the needs of each company.
3. Establishing the criteria. These are definitely dependent upon the conditions in which the individual company finds itself and usually change from time to time.

The implementation activities are search-

ing, screening, coordinating, formalizing, evaluating, budgeting, requesting authority for expenditure, process controlling, and following up.⁴

Evaluation

At this point it is necessary to consider mathematical evaluation. This is probably the area which affects accountants more than any other. Evaluation and capital budgeting call for increasingly sophisticated techniques and comprise one of the most important areas of strategic decision making for management. As such, they will benefit from the skills and insights of present-day accountancy.

The most common methods of evaluation are payback (or payout), average rate of return, and the newer concepts that employ the time value of money: net present value computations and the discounted rate of return based on analysis of cash flows.

"The 'raw materials' for proper evaluation of a capital expenditure are estimates of cash flows associated with that outlay. . . . The underlying concept involved in capital budgeting is that money has a time value; that is, that a dollar received tomorrow does not have the same present value as a dollar received today."⁵

Payback is probably the most widely used of the evaluation methods. Its popularity is no doubt due to its simplicity since it is easy to measure the length of time necessary for the sum of net cash savings to equal the initial outlay. Unfortunately, however, it is also the most inconclusive and misleading method for major expenditures. Payback considers neither the time value of returns nor any income resulting beyond the payback period. If a firm is short of cash, the payback period may be used to emphasize projects with a quick return. However, where there is room for maneuvering, the payback should not be relied on alone for comparison of alternatives.

The second method, the average rate of return, is the percentage of average annual net income after taxes to the average investment required over the life of the project.⁶ The average investment required for depreciable assets is considered to be one-half of the original investment since the whole amount is expected to be recovered over the life of the project through depreciation. With this method, the time value of money is again ignored and the basis of computations is accounting data, not cash flows. However, if the return is expected to be fairly consistent from year to year, this method will provide a satisfactory estimate.

EXHIBIT A

Three Evaluation Methods Applied

| Time in Years | Investment Required | Depreciation Expense | Net Income | Cash Flow | Present Value at: | |
|---------------------|------------------------|-------------------------|----------------|-----------------|-------------------|----------------|
| | | | | | 11% | 12% |
| 0 | \$-10,000 | | | \$-10,000 | \$-10,000 | \$-10,000 |
| 0-1 | - 1,000* | \$ 1,000 | \$ 250 | 250 | 237 | 236 |
| 1-2 | - 500* | 1,000 | 1,000 | 1,500 | 1,272 | 1,254 |
| 2-3 | - 500* | 1,000 | 1,250 | 1,750 | 1,330 | 1,297 |
| 3-4 | | 1,000 | 1,250 | 2,250 | 1,532 | 1,497 |
| 4-5 | | 1,000 | 1,250 | 2,250 | 1,372 | 1,312 |
| 5-6 | | 1,000 | 1,250 | 2,250 | 1,229 | 1,164 |
| 6-7 | | 1,000 | 1,250 | 2,250 | 1,101 | 1,032 |
| 7-8 | | 1,000 | 750 | 1,750 | 767 | 712 |
| 8-9 | | 1,000 | 250 | 1,250 | 491 | 451 |
| 9-10 | | 1,000 | (250) | 750 | 264 | 240 |
| 10 | 2,000** | | | 2,000 | 666 | 602 |
| | <u>\$-10,000</u> | <u>\$10,000</u> | <u>\$8,250</u> | <u>\$ 8,250</u> | <u>\$ 261</u> | <u>\$ -203</u> |

$$\text{Discounted cash flow rate of return} = 11 + \frac{261}{261 + 203} (1\%) \text{ or } 11.5\%$$

$$\text{Rate of return on average investment} = \frac{\$825}{\$6,000} \text{ or } 13.8\%$$

$$\text{Payback} = 5.9 \text{ years}$$

*Added working capital requirement

**Recovery of working capital

Source: Edwin A. Bowen, "Problem Areas in Use of Discounted Cash Flow for Investment Evaluations," *NAA Bulletin*, XLIV Number 12 (August 1963), p 13.

However widely used, the payback and average rate of return methods of evaluation are not as conceptually sound as present value interpretations of future benefits. These are briefly defined as:

Net Present Value Method: present value of future returns discounted at the appropriate cost of capital minus the cost of the investment.

Internal Rate of Return Method: interest rate which equates the present value of future returns to the investment outlay.

Benefit/Cost Ratio, or Profitability Index: present value of future returns divided by present value of the investment outlay.⁷

The internal rate of return method, known variously as the discounted rate of return, investor's method, and time-adjusted return, develops comparison return rates for proposed projects. It thus transcends the usefulness of the net present value method which gives only a go, no-go decision and makes no provision for ranking of mutually exclusive projects.

The actual computations involved in the payback, average rate of return, and discounted rate of return methods are illustrated in Exhibit A. They are based on the same set of facts. The net income plus depreciation

accumulates to the \$12,000 investment in 5.9 years to give the payback period. The income for ten years is \$8,250 and represents \$825 per year. Related to half the investment (\$6,000), this gives a return of 13.8%. The net cash flows of \$8,250 are equated between an 11% discount where they are \$261 inflow and a 12% discount where they are \$203 outflow. Interpolation yields 11.5% as the point of equality, i.e., the rate of earnings under the discounted cash flow rate of return.⁸

Equivalent Annual Amount

A further method for evaluating investment projects was, in the words of its originators, "born out of a desire to find a method that would not only be in harmony with the usual criteria of understanding, recording and discussing business performance, but would also bring together the best features of present investment analysis concepts".⁹ This is still not the ideal, but it may be a major improvement on existing methods. The "equivalent annual amount" (EAA) is a time adjusted average which may be substituted for the average annual net income after taxes in the average rate of return method. This eliminates one of the major deficiencies of that method—

EXHIBIT B

Equivalent Annual Amount

| <i>Year</i> | <i>Series</i> | <i>Discount Factor</i> | <i>Present Value</i> |
|-------------|---------------|----------------------------|--------------------------|
| 1 | 250 | 0.909 | 227.250 |
| 2 | 1,000 | 0.826 | 826.000 |
| 3 | 1,250 | 0.751 | 938.750 |
| 4 | 1,250 | 0.683 | 853.750 |
| 5 | 1,250 | 0.621 | 776.250 |
| 6 | 1,250 | 0.564 | 705.000 |
| 7 | 1,250 | 0.513 | 641.250 |
| 8 | 750 | 0.467 | 350.250 |
| 9 | 250 | 0.424 | 106.000 |
| 10 | (250) | 0.386 | (96.500) |
| | | <u>6.144</u> | <u>5,328.000</u> |

$$5,328.000 \div 6.144 = 867.1875$$

As applied to the rate of return on average investment formula: $\frac{\$867.1875}{\$6,000} = 14.4\%$

Source: Lee C. Raney, Karsten A. Rist and Henry A. Wiebe, "The Equivalent Annual Amount Method—A New Approach to Investment Analysis," *NAA Bulletin*, XLVI Number 8 (April 1965), p 26-27.

ignoring the time value of money.

The EAA can be computed in four easy steps:

1. Each one of the unequal values is multiplied by the corresponding discount factor. The result is a present value.
2. The discount factors are summed.
3. The present values are summed to form the total present value of the series.
4. The total present value of the series is divided by the sum of the discount factors.¹⁰

These steps necessitate the determination of a certain cost of capital on which the discount factor is based. Measurement of capital cost is no trivial task. "The firm should be viewed as an on-going concern, and its cost of capital should be calculated as a weighted average of the various types of funds it uses: debt, preferred stock, and equity."¹¹

Increasingly important in current financial analysis is the concept of the marginal cost of capital, defined as the cost of the last dollar of new capital raised during the year.¹²

Exhibit B shows the application of the Equivalent Annual Amount method to the same facts used for Exhibit A. The cost of capital used was 8%.

Extending the Payback Concept

As stated earlier, payback is the most popular method of evaluating capital expenditure proposals. If the company will not accept

different methods, the least the accountant can do is make the one they are using as accurate as possible. Perhaps with this aim in mind, the latest addition to evaluation methods has been developed—the discounted payback period.

The conventional payback method, as has been shown, ignores the cost of capital concept. The discounted payback period is the time it takes a project's incremental cash flows discounted at the opportunity investment rate (the rate that could be earned on alternative investments having a like risk) to accumulate to investment outlay.¹³ Basically, this method is still answering only the break-even question—when will outlay be equaled by income? However, it does consider the time value of money and with little added effort it can be extended to take into account the income beyond payback date. This results in a profitability index which is comparable to ratings developed through a discounted cash flow method. It is actually the ratio of the present value of incremental cash flows to the present value of the required investment.¹⁴ The example presented in Exhibit C, based again on Exhibit A data for ease of comparison, is extended to show both the payback date and the profitability index.

Application

Now that all these intricate rates of return have been developed, what does one do with them? Obviously, in a comparative series,

EXHIBIT C

Discounted Payback Period

| Year | Investment Outlay | Cash Flow | Present Value of \$1 Discounted at 8% | Present Value of Incremental Cash Flow | Cumulative Present Value Incremental Cash Flow | Percent Investment Recovery |
|------|----------------------|--------------|--|---|---|-----------------------------------|
| 0 | \$-10,000 | | | | | |
| 1 | - 1,000 | \$ 250 | 0.926 | \$ 231.50 | \$ 231.50 | 2.315 |
| 2 | - 500 | 1,500 | 0.857 | 1,285.50 | 1,517.00 | 15.170 |
| 3 | - 500 | 1,750 | 0.794 | 1,389.50 | 2,906.50 | 29.065 |
| 4 | | 2,250 | 0.735 | 1,653.75 | 4,560.25 | 45.603 |
| 5 | | 2,250 | 0.681 | 1,532.25 | 6,092.50 | 60.925 |
| 6 | | 2,250 | 0.630 | 1,417.50 | 7,510.00 | 75.100 |
| 7 | | 2,250 | 0.583 | 1,311.75 | 8,821.75 | 88.218 |
| 8 | | 1,750 | 0.540 | 945.00 | 9,766.75 | 97.668 |
| 9 | | 1,250 | 0.500 | 625.00 | 10,391.75 | 103.918 |
| 10 | | 750 | 0.463 | 347.25 | 10,739.00 | 107.390 |
| 11 | 2,000 | 2,000 | 0.429 | 858.00 | 11,597.00 | 115.970 |

Discounted payback date, approximately = 8.5 years

8th year . . . 97.668% returned

8th year + . . . 100.00% returned

9th year . . . 103.918% returned

Profitability index = 115.970% ie., 15.97% rate of return

Source: Alfred Rappaport, "The Discounted Payback Period," *Management Services*, Vol. 2, No. 4 (July-August 1965), p 32.

the project with the highest rate is most desirable. But does this necessarily mean that the project should be implemented? No, not if the objective is profitability.

Bierman and Smidt prescribe selection of those projects for investment which:

“. . . return more than the cost of capital to the corporation. Specifically, if all projects are arranged in order of decreasing profitability, the last one to be accepted is that which returns earnings at a rate equal to the cost of the last and most expensive increment of capital. When the so-called 'marginal cost of capital' is known, all projects, whose net present value is positive when discounted at that rate, should be accepted.”¹⁵

Theoretically, adoption of a project which shows a positive net present value will ultimately show an increase in the market value of the firm. This is public recognition of attainment of the objectives of the organization. In the language of economics and finance,

“Shareholders' utility is maximized when the firm's current market value (the present value of future dividends or other withdrawals) is maximized; and the firm's market value is the sum of the present values of accepted projects.”¹⁶

For a project to be profitable, the rate of return must exceed the cost of capital. If all additional capital involved in the project is to be borrowed, the task of determining a cost is quite simple. It is the same as the effective interest rate that will be charged. But if, as is generally the case, the capital is generated by the company itself, the task can be formidable. However, this is another whole area as large and complicated as the present subject, involving as it does opportunity costs, cost of retained earnings, depreciation allowances, and many other factors. So it will be left for another time. Let it suffice to say that the cost of capital must at least be estimated.

Another problem area is the allowance for a risk factor. Risk itself is not expressible quantitatively. Techniques for decision-making under uncertainty have proliferated since the advent of electronic data processing, but it must be recognized that attaching a weight to a discount rate because of an element of risk is, in itself, an expression of qualitative judgment.

Although statistically indefensible, simple ranking techniques can be very effective when practiced by informed and competent managers. This is especially true if they have had guidance by the professional accountant. In the heuristic solution of capital budgeting problems, it is expected that decision makers

will use their best judgment.

Ranking as selective methodology can become more complicated, and perhaps less reliable, as the number of budget constraints increases, i.e., complicating a simple project rate of return with elements of risk of venture. The complications may eventually require mathematical programming as an aid to solution. Also, "for time-phased investments, the returns of which interact over time, programming models can be formulated to select the most 'robust' or flexible path for growth."¹⁷

There are still other pitfalls to be avoided in evaluating a capital expenditure proposal. One is in compiling the data to be used in the formulas. Cost estimates are generally biased downward. Several explanations are offered and they probably all have some effect. The proponents are naturally over-optimistic and this is usually recognized. The figures which are used are often taken from completed projects. To be completed, it must have been selected in the first place. And one of the factors influencing its selection was probably its lower costs. Also, some required resources are easily overlooked in the initial planning and evaluation stages. Among these may be additional training or weather-control measures necessary to the efficient operation of equipment.

The client, or management, may be made more aware of the dispersion of possible outcomes from an investment by a *sensitivity analysis*. This process determines the effect upon net present value of possible variations in the factors used to estimate after-tax flows of cash.¹⁸

Follow Up

Now that the thread of thought has woven its way in and out among the various methods and their advantages and disadvantages, the reader may be inclined to breathe a sigh of relief. One should be cautioned, however, to

not forget the last step in this suggested series of activities—the follow up. One of the most important, yet most neglected, aspects of any capital expenditure program is the post-completion audit. It is management's measure of accuracy for their decision. Perhaps it is unfortunate decisions which lead to management's "forgetfulness" regarding these audits. But this is no excuse. Facing the fact of fallibility can be a learning experience.

The accountant surely realizes the importance of the audit in all other applications. It is up to him to convince management of its value here. No matter what method of evaluation was used, the chosen project was planned. It should also be controlled step by step. The knowledge that an audit will be made promotes control, and good control makes the audit a much simpler matter.

Here again, the field is too broad for exacting consideration at this point. Every company would probably be better off developing its own post-completion audit program for capital expenditures. The point to be made here is that the program, with strict rules or flexible guidelines, should be developed for management by the accountant. Management cannot afford the time for a long, involved story that omits the most important part, the punch line. Likewise, it is unfair to take the manager down the long road of capital expenditure evaluation and then to omit the area of real value for the future, the post-completion audit.

Why

Why bother with all this? Why measure return on capital? The applications and definitions differ; the results are imperfect. The investor is concerned with dividends and the manager is concerned with salaries; but, in the long run, both must be subordinated to the basic yield on capital utilized. The return on investment concept is the acid test for investor and manager alike.

NOTES

¹Robert W. Johnson, *Financial Management*, 4th Edition; (Boston: Allyn and Bacon, Inc., 1972) p 149

²Elmer L. Winter, "What The Corporate President Wants From His Accounting Firm," *The Journal of Accountancy*, Vol. 134, No. 1, (July 1972) p 56

³Edward Fylstra, "The Small Practitioner's Role in Management Services," *The Journal of Accountancy*, Vol. 119, No. 4 (April 1965) p 96

⁴Milton F. Usry, "A Capital Expenditures Framework," *NAA Bulletin*, XLVI Number 3 (November 1964), p 13-19

⁵Johnson, *Financial Management*, p 150

⁶*Ibid.*, p 167

⁷J. Fred Weston and Eugene F. Brigham, *Managerial Finance*, 4th Edition, (New York: Holt, Rinehart and Winston, Inc., 1972) p 143-4

⁸Edwin A. Bowen, "Problem Areas in Use of Discounted Cash Flow for Investment Valuations," *NAA Bulletin*, XLIV Number 12 (August 1963), p 12-13

⁹Lee C. Raney, Karsten A. Rist and Henry A. Wiebe, "The Equivalent Annual Amount Method—A New Approach to Investment Analysis," *NAA Bulletin*, XLVI Number 8 (April 1965) p 25

¹⁰*Ibid.*, p 26

¹¹Weston and Brigham, *Managerial Finance*, p 301

(Continued on page 18)

Introduction

APB No. 7 entitled "Accounting for Leases in Financial Statements of Lessors" deals with this subject, but many questions regarding its interpretation have arisen since it was adopted in 1966.

Discussion

Some of the circumstances which have arisen in which it is difficult to know if the transaction should be recorded as a lease or as a sale are:

- (1) Where property is delivered under a cancellable lease, or
- (2) Where property is delivered under a noncancellable lease which extends for only a portion of the useful life of the property.

Sometimes it was assumed that a cancellable lease would not actually be cancelled. And sometimes it was assumed that a noncancellable lease would be renewed when it was for a period of less than the useful life of the property. Such determinations are often extremely difficult, and some assumptions made that leases would continue even though not under legal obligation to do so were often not realized.

For this reason, the Board tentatively concluded that something more specific was needed to determine when a lease should be recorded as a sale. The Opinion is to supersede parts of the prior APB No. 7. However, the Opinion is not to apply to lease agreements of land or natural resources nor to financing transactions of financial institutions.

Opinion

The draft concludes that a lease should be recorded as a sale if collection of the payments is reasonably assured, no important uncertainties exist regarding costs yet to be incurred, **and** if any one of the following conditions is present:

- (1) Title will be transferred without cost or only with nominal cost at the end of its noncancellable term,

- (2) Similar property is available for sale and the present value of the lease together with any related investment credit equals or exceeds the usual selling price (or the fair value of the property in the absence of a normal selling price),
- (3) If the selling price cannot be determined, the noncancellable term of the lease is substantially equal to the useful life of the property.

The draft goes on to point out that a high credit risk presents problems in determining the interest rate to be applied in computing present value of the lease payments. If the credit risk is so high as to preclude reasonable assurance of collection, it is then improper to record the lease as a sale.

When a lease is recorded as a sale, the amount recorded as revenue should be the present value of the payments (over the noncancellable term) and the amount charged against income should include the cost of the property plus the present value of any estimated future costs.

If important uncertainties exist (such as unusual guarantees of performance or protection from obsolescence), the maximum potential risks may be so great that the lease should be accounted for by the operating method.

Leases other than those meeting the criteria described above should be accounted for by the operating method as set forth in APB No. 7.

Third Parties

If the manufacturer or dealer sells or assigns the lease to an independent financial institution, the lease should be recorded as a sale where the usual risks of ownership are transferred. But where the risks and rewards of ownership are not transferred, the records should not reflect the transaction as a sale.

Leases sold or assigned to related companies should have the same considerations applied; in addition, it may be necessary to eliminate inter-company profits or losses.

Valuation of Capital Expenditures

(Continued from page 10)

¹²*Ibid.*, p 317

¹³Alfred Rappaport, "The Discounted Payback Period," *Management Services*, Vol. 2, No. 4 (July-August 1965) p 32

¹⁴*Ibid.*, p 35

¹⁵Bierman, Harold, Jr., and S. Smidt, *The Capital Budgeting Decision*, 2nd Edition, cited by Joseph L. Bower, *Managing the Resource Allocation*

Process, (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1970) p 283

¹⁶Stewart C. Myers, "A Note on Linear Programming and Capital Budgeting," *The Journal of Finance*, Vol. XXVII, No. 1 (March 1972) p 92

¹⁷H. Russell Fogler, "Ranking Techniques and Capital Budgeting," *The Accounting Review*, Vol. XLVII, No. 1, (January 1972)

¹⁸Johnson, *Financial Management*, p 170