

## Criteria for major investment decisions

### Abstract

*This article surveys the quality of capital investment decision-making of leading South African firms. The results, based on 132 responses suggest that, while some firms are advanced, one firm in twenty did not use any of the required capital budgeting techniques for decisions. In addition, the findings provide interesting information on the methods used by firms to assess the impact of inflation on cash flows and the assumptions made with respect to reinvestment rates of cash inflows and, risk and non-financial criteria. The findings suggest that larger firms employ more sophisticated techniques and that high levels of analytical quality are positively correlated with corporate growth rates and profitability.*

### Introduction

In every business, several functional areas of management, eg, production, marketing, data processing and personnel, combine in the taking of decisions on major investment proposals. All these need to be integrated formally into the evaluation process and are vitally affected, in turn, by capital budgeting decisions.

All executives, no matter what their primary responsibility, must be aware of how major investment decisions are made and must provide data and information from their own sphere of operations.

Investment decisions make a commitment to the future – once made, the decision influences a firm for years to come. Major investments are an integral part of a firm's long-term strategy. A serious effect is the loss of flexibility when resources are allocated.

If the firm over-invests, profitability is reduced. On the other hand, if it under-invests, equipment may rapidly become uncompetitive due to a loss of relative technical sophistication or capacity, and this may lead, ultimately, to the loss of share in a growing market. Regaining market share is normally associated with vigorous marketing effort, price competition and further investment in fixed assets as capacity constraints are reached. These combined activities may place additional stress on the firm's resources.

The complexity of the strategic investment process, based as it is on the combined input from different functional areas within the firm, where objectives, philosophies, rewards and cultures vary dramatically, requires that decision-making be relatively rigorous and that the criteria used to evaluate proposals be understood by the managers involved in the commitment of large amounts of cash over extended time horizons.

The financial executives making major investment decisions have a wide variety of capital budgeting tools from which to choose. Each have their own assumptions, strengths, weaknesses and degrees of complexity. In order to assess the methodology of the capital investment process, a survey was undertaken which sought to answer the following questions:

- How advanced are South Africa's financial decision-makers in the using of the tools available?
- Is there significant correlation between the sophistication of the capital budgeting techniques adopted by firms and their economic variables?

This paper reports on the results of the survey and also puts forward guidelines to assist managers involved in the capital budgeting function.

### Outline of the research

Methods used in capital budgeting in South Africa can arbitrarily be divided into two categories, namely, those commonly used by financial managers and those involving more exotic extensions of established techniques.

This research concentrated on the first of these. The more common of the techniques considered were:

- (i) Payback period.
- (ii) Accounting rate of return.
- (iii) Net present value.
- (iv) Profitability index.
- (v) Internal rate of return.

Using a questionnaire, data were gathered from investment decision-makers in some of South Africa's largest industrial and mining corporations in respect of such issues as:

- Which of the techniques were employed?
- When were the techniques introduced?
- How were such complicating factors as inflation, risk and mutually exclusive alternatives dealt with?

The subject of research considered here has been of interest for some time to American and European firms. This study into the South African situation followed an approach similar to that adopted by Fremgen, Klammer, Petry and Schall et al<sup>7, 9, 14, 15</sup>. The questionnaires were mailed to the chief financial officers of 500 of South Africa's major mining and industrial companies. 132 replies were received.

The respondent sample as a percentage by industry sector is given in Table I. Respondents were not asked to identify themselves or their firms. However, they were asked to indicate economic characteristics such as total assets, capital budget size, growth and profitability to assist in categorisation.

**Table I: Sample as a percentage by industrial sector**

Industry class	Percentage
Mining	4,8
Wood, pulp and paper	6,4
Primary metals and fabrication	5,6
Petroleum and chemicals	13,6
Food, beverage and tobacco	16,8
Electrical and electronic products	4,0
Automotive products	8,0
Miscellaneous manufacturing	16,0
Industrial equipment	2,4
Construction	4,0
Department supermarkets and variety stores	4,0
Household and personal products	9,6
Other	5,6

### Analysis and interpretation of the data

#### (a) Methods in actual use

Respondents to the questionnaire were asked which capital budgeting methods they used in evaluating the

profitability of a proposed major investment. Table II shows that the most popular method used is the payback period – rated in theory <sup>2</sup>(p 42) as being unsophisticated and definitely a poor technique for use as the sole means of evaluating investments. However, the discounting methods (internal rate of return, net present value and profitability index) received considerable support. It will be noted that the percentages total far more than one hundred per cent. As usage of several methods was common – the average number of techniques used per firm was 2,31. The firms were asked if they used any technique aside from those tabled and several “other” techniques were listed. The CAPM, MAPI and assessment of dividend and earnings yield were the most common mentioned in this section. Table II indicates that

time-weighted criteria play a more important role in firms with larger capital budgets. No definite trend is discernible in the data regarding the other methods surveyed.

The respondents were also asked what their primary method of evaluation was at present, and had been 5 and 10 years ago respectively. The findings appear in Table III. What is illustrated is a trend, with time, away from the less sophisticated methods of payback period and accounting rate of return to the more sophisticated time-weighted methods of internal rate of return (IRR) and net present value (NPV). The sample revealed that 57,3% use time-weighted methods as the most important basis for evaluation.

**Table II: Capital budgeting methods in use in South Africa**

Size of annual capital budget	Technique employed					
	Internal rate of return (IRR)	Net present value (NPV)	Profitability index (PI)	Payback period (PB)	Accounting rate of return (ROR)	Other
Over R50 million	40,9%	81,8%	9,1%	72,7%	45,2%	0,0%
R25 million – R50 million	80,0%	46,7%	13,3%	66,7%	46,7%	20,0%
R10 million – R25 million	63,2%	42,1%	15,8%	68,4%	47,4%	10,5%
R5 million – R10 million	68,7%	37,5%	12,5%	93,7%	43,8%	12,5%
R2 million – R5 million	63,2%	36,8%	26,3%	84,2%	42,1%	5,3%
Below R2 million	36,6%	31,7%	12,2%	51,2%	34,1%	4,9%
All respondents	59,5%	39,7%	14,1%	68,6%	41,3%	8,3%

**Table III: Historical analysis of most important capital budgeting method in use**

Capital budgeting method	Year		
	1982	1976	1971
Internal rate of return	45,3%	37,3%	27,0%
Net present value	7,7%	6,6%	5,4%
Profitability index	4,3%	3,3%	6,8%
Payback period	26,5%	27,5%	32,4%
Accounting rate of return	15,4%	24,2%	27,0%
Other	0,8%	1,1%	1,4%
Totals	100,0%	100,0%	100,0%

Of particular interest is the fact that although the payback period was used by 68,6% of the respondents, only 26,5% used it as the prime method of evaluation.

In comparison with American usage in the early 1970s<sup>7,9</sup>, the payback period was more popular in South Africa in 1982, both as a primary and combined evaluation technique. As regards a primary evaluation technique, more of the South African respondents used a discounting method (52,7%) than Fremgen’s American sample in 1972 (42%).

Analysis of the use of multiple methods reveal that South African respondents used slightly more techniques on average than respondents in the early and mid-1970s findings of Fremgen and Petry<sup>14</sup> but less than the 2,56 average found among respondents in the study by Schall et al<sup>15</sup> (1978). As in Fremgen’s sample, the firms with larger capital budgets were more likely to employ several techniques – ranging from a 2,99 average for those with capital budgets of greater than R50 million to 1,70 for those with capital budgets of less than R2 million per annum.

The type of investment to which South African firms employed modern budgeting techniques was investigated. Over 40% said they used the techniques for all investment decisions and 43% said that they restricted their use to investment purposes over a set amount. The average value of this amount was R148 546 with a standard deviation of R259 672. This value was, thus, extremely wide, ranging from R100 up to R1 000 000. Of the remaining respondents, 5,9% claimed they did not use capital budgeting techniques for any investment decision! Given that the firms sampled are regarded as leading firms, this finding is surprising. The fact that one out of 20 of the leading firms relies totally on intuition is alarming. The remaining 10% said that they only employed capital budgeting techniques for certain types of investment. Among those names were investments for new products, major expansions, take-overs and capital used in the production of income. One comment was that capital investment analysis and budgeting was not necessary in strategic decisions!

Table IV summarises the findings.

**Table IV: Types of investments where capital budgeting methods are employed**

Type of investment	Percentage of respondents using capital budgeting methods
All	40,7%
None	5,9%
Restricted to over a certain amount	43,2%
Restricted to certain types of investment	10,2%
Total	100,0%

*(b) Treatment of risk and uncertainty*

A far more demanding problem than projecting a return on a given set of assumptions is analysing the impact of changes in the assumptions themselves. Each assumption involves its own degree of uncertainty and often this is relatively high. Integrating all the uncertainties into a model can multiply effects into an overall degree of uncertainty of excessive proportions<sup>8</sup>.

Of the firms responding, 76,8% made some explicit adjustment to account for risk and uncertainty. Hence, nearly a quarter of the firms are ignoring a critical factor in assessing major investments and, another quarter of the firms are using subjective judgement alone to cater for risk. A summary of the findings appears as Table V.

**Table V: Adjustments made for risk and uncertainty**

Risk adjustment method	Percentage of firms using methods
Requirement of higher-than-normal index of profitability	37,5%
Requirement of shorter-than-normal payback period	31,7%
Adjustment of cash flow by probability factors	14,2%
Purely subjective non-quantitative adjustment of cash flows	27,5%
No adjustment made	24,2%
Other methods	2,5%

The techniques specified under "Other methods" were stochastic models, break-even analysis of the cash flows and attempts to apply the capital asset pricing model.

When compared to results in American research, the South African firms appear to be lagging in terms of sophistication regarding risk adjustment.

*(c) The effects of inflation*

The respondents were also required to indicate what methods they used to take account of inflation. Findings are presented in Table VI.

**Table VI: Adjustments made for inflation**

Inflation adjustment method	Percentage of firms using method
No allowances made for inflation	42,4%
All items in cash flow inflated at an agreed rate	48,0%
Inflated at an agreed rate for a certain number of years	4,8%
Some other method	3,2%

An analysis of the effects of inflation on cash flows provides a theoretical basis which makes it obvious that it is essential that cash flows be adjusted for the effects of inflation when assessing major investments – yet over 40% of the respondents make no such allowances. Several firms inflated items in their cash flows for a specific number of years and then continue cash flows unadjusted for the remainder of the life of the project. The average period of the inflation allowance for these firms was 6,75 years – the shortest being 2 years and the longest 10 years with a standard deviation of 3,95 years.

Almost one-half of the respondents inflated all items in the cash flow but some listed other methods such as viewing current economics and subjecting the payback calculation alone to inflation.

*(d) Rate of return on reinvestment*

The use of time value of money methods entails an implicit assumption that cash flow from any investment will be reinvested at some rate implied specifically by the model being used.

For example, the IRR measures the relative profitability of investments by identifying the return on the declining balance of funds invested. Inherent in the technique is the assumption that immediate cash flows generated in each period are reinvested at the IRR. In contrast, the NPV, which uses a particular discount rate, assumes reinvestment of cash flows generally at that rate of return.

The use of the IRR will maximise net worth if the actual attainable reinvestment rate is equal to or greater than that rate of discount which equates the present values of project cash flows with the investment outlay.

Thus, a "reinvestment rate problem" arises because the mathematical models used by the discounted cash flow techniques assume a single reinvestment rate as well as magnitude, duration and pattern of the cash flows. From a practical point of view, the policies and circumstances faced by a particular firm will almost certainly invalidate such an assumption.

Respondents to the survey were asked whether they made any explicit assumption about the rate of return to be earned on reinvested funds. Only 17% of those who answered the question made an assumption regarding reinvestment rates of return. In most cases, this was their cost of capital rate which is implicitly assumed in the NPV model in any event.

Fremgen, in his study of American firms in 1971, found that a substantially higher percentage, namely 29% of firms, made explicit assumptions on the models they used. This provides further evidence that South African firms lag behind their American counterparts in terms of investment sophistication.

*(e) Choice between mutually exclusive alternatives*

When faced with mutually exclusive alternatives there are several potentially troublesome areas, from a theoretical point of view. The literature is generally in agreement, however, <sup>4</sup>(p 21) that these should be analysed by the use of incremental cash flows, ie subtracting the cash flows associated with one alternative from those related with another. The survey of current practices by South African firms shows only 31% of the responding firms apply this technique. Most of the respondents (54,9%) stated that they decide on the alternative that gives the best rating as determined by the index of financial attractiveness they regularly use. In many cases, this technique will give the same decision as the incremental cash flow technique, but this cannot be relied upon.

Several other methods were proposed by the sample – many of them non-financial. When looking at the supply of machinery or plant, the reliability of the supplier, service, availability of spares and location were considered key aspects.

*(f) Non-financial criteria*

The American researchers cited several examples where non-financial criteria were used in the investment decision process. These related to governmentally required projects such as projects for safety or pollution control and projects concerned with employee morale.

From the South African sample, respondents totalling 93% said they accepted projects that were non-economi-

cally motivated. The South African firms seem less concerned with employee safety or comfort than their 1971 American counterparts and also show, wisely, less propensity to maintain uneconomic existing programmes or product lines. The findings appear in Table VII.

**Table VII: Non-financial criteria used in major investment decision**

Non-financial criteria	Percentage of firms applying criteria	
	South Africa	USA (1971) Ref 7
Investments never accepted on non-financial grounds	7,2%	—
Safety of employees or the public	61,6%	92%
Necessity of maintaining existing programmes or product lines	51,2%	79%
Employees' convenience or comfort	48,0%	77%
Social concern or enhanced community relations	40,0%	69%
Pollution control	57,6%	10%
Legal requirements	58,4%	7%
Unmeasurable long-term potential (such as R and D programmes)	30,4%	5%
Contractual commitments	19,2%	2%
"Seat of Pants" judgement	16,0%	—

**Sophistication in investment decision-making**

Although American researchers in several instances refer to sophistication in capital budgeting techniques, none attempted to find a tangible integrated measure for this. Great difficulties occur in assessing a firm's sophistication in terms of its understanding and application of capital budgeting techniques, the assumptions made and its knowledge and understanding of the difficulties, advantages and disadvantages of the techniques concerned. In order to obtain a basis for comparison between firms, a subjective indexing system was developed.

With the co-operation of a panel of knowledgeable financial analysts, five key factors in a firm's investment decision practice were rated <sup>2</sup>(p 124). These were:

- most important capital budgeting method used;
- risk assessment method;
- allowance made for inflation;
- analysis of mutually exclusive alternatives;
- technique for dealing with reinvestment of cash flow.

Ratings for each factor produced scores between 0 and 10, with 0 indicating a low level of sophistication and 10 a very high level of sophistication. Using weighting factors agreed upon by the financial analysts, the ratings were combined into a single Sophistication Index.

The fact that a wide variation in sophistication exists is indicated by high standard deviations and relatively low correlation coefficients. Apart from endogenous characteristics producing this wide variation, several technical reasons can be postulated that would explain it.

**Table VIII: Sophistication in capital budgeting by industry category**

Industry sector	Mean Sophistication Index	Standard deviation
Coal, petroleum and chemical industries	90,1	30,6
Supermarkets, department and variety stores	88,8	29,1
Automotive products	78,9	30,7
Mining	77,1	33,7
Miscellaneous manufacturing	75,0	36,5
Food, beverage and tobacco	74,4	30,2
Other	71,5	38,5
Primary metals and fabrication	68,6	28,3
Wood, pulp and paper	65,0	29,8
Electrical and electronics	64,5	41,9
Construction and industrial equipment	52,0	47,9
Household and personal products	49,7	37,8

The mean Sophistication Index and its standard deviation by industrial sector appear in Table VIII. The listing is arranged in descending order of sophistication.

"Petroleum and chemical industries" and "Automotive products" rank near the top of the list in line with the findings of Petry and Schall et al in their investigations. Being capital intensive with medium to long-term planning horizons, these industries will benefit more than most from a high level of sophistication in capital budgeting. The high degree of sophistication shown by South African supermarkets, department and variety stores is somewhat surprising – possibly an indication of the successful trend to hyper-stores which need careful financial planning and investment decision-making.

"Electrical and electronic products" and "Wood, pulp and paper" do not show high sophistication and this is in keeping with Petry's findings. However, the samples from these industries was not large (see Table I) and the large standard deviations indicate a wide variation within these samples.

Linear regressions of the Sophistication Index against the net asset size, capital budgets size, growth rate and profitability of the respondent firms provide interesting correlations.

The "best fit" relationships and some parameters of the correlations are given in Figure I.

In general the sample reveals:

- (i) Larger firms are more sophisticated in capital budgeting techniques than smaller firms.
- (ii) Firms having larger capital budgeting expenditures use more sophisticated capital budgeting techniques.
- (iii) Firms that are using more sophisticated capital budgeting techniques are growing faster.
- (iv) Firms that are using more sophisticated capital budgeting techniques are more profitable.

**Conclusion**

Response bias is obviously possible in a survey of this nature but was found not to be a major factor in previous capital budgeting surveys in America. For example, Schall et al<sup>15</sup> comment in their paper – "A questionnaire

follow-up to 16 randomly selected non-respondents was carried out, and answers to the questionnaire obtained from 15 of them. The results of this follow-up analysis indicate there is little response bias; the follow-up firms were slightly (not statistically significant) more sophisticated in methods used for capital budgeting and slightly less sophisticated in risk assessment methods. Thus, response bias does not appear to be a major factor . . ." Allowing for this, a definite trend to more sophisticated techniques is noted in the large South African firms from the early seventies to the present.

The survey indicates that time-weighted techniques are becoming more widely used at the expense of non-time-weighted techniques such as the accounting rate of return. This is especially prevalent with regard to a prime evaluation standard. Also noted is the use of multiple methods by most firms. As an overall evaluation, the present use of capital budgeting techniques by South African firms appears, in sophistication, to be equivalent to that found in American firms in the period 1975 to 1978.

However, of particular concern is the fact that a wide gap between theory and practice still exists with nearly a quarter of the sample stating that they make no allowance for risk and uncertainty and a further quarter are using only subjective judgement to cater for risk. Inflation is completely ignored by over 40% of the respondents. Additionally, over half do not use theoretically correct methods for assessing mutually exclusive alternatives and less than 20% make explicit assumptions regarding reinvestment rates of cash flows generated.

When firms are compared using the Sophistication Index it can be inferred that those firms not adopting a sophisticated approach to capital budgeting are forfeiting both profitability and growth. The implications are clear. South Africa has limited resources and these must be allocated to those projects which will maximise shareholder wealth. These research findings, based on a survey of leading South African firms, suggest that the objective of optimal resource allocation is far from being attained. The research suggests that increased sophistication in capital budgeting is correlated with performance. This is not unexpected. What is surprising is the poor conceptual understanding of what are, after all, fairly simple techniques and the failure to adjust for or take account of such initial issues as inflation. The fact that the respondents were the chief financial officials of leading South African firms gives cause for concern regarding the training that these executives have received. The tendency in South Africa has been for executives with an accounting background to be appointed to financial positions and few would argue with the proposition that accounting and finance, although related, are different.

Finance is a top management function. As such it is concerned more with the long-term strategic issues of the firm. The lack of sophistication suggested by these research findings, implies that strategic issues are being neglected and that resources are perhaps being misallocated.

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