

CAPITAL INVESTMENT APPRAISAL TECHNIQUES: A SURVEY OF CURRENT USAGE

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INTRODUCTION

Organisational change, fuelled by the expansion of information technology, may have contributed to the erosion of the previously established relationship between company size and the quantitative investment appraisal criteria selected. This paper compares the results of a survey of the 500 largest Scottish companies with the findings of earlier UK studies and finds that companies are using more methods together, that usage of the more sophisticated discounted cash flow techniques is higher, and that usage of the less theoretically sound accounting rate of return technique is lower, than previous studies would have suggested for companies of the size involved. It concludes that a size/method selection relationship may only be identifiable when the companies involved are all part of one study, or the studies compared are contemporaneous.

The paper begins with a consideration of the process of organisational change: accounting is not a closed system. It exists within an environment (the organisation) and is subject to changes in that environment. It is also subject to changes in the wider environment outside the organisation. Thus, accounting change will result from events arising within the organisation in which it is operating, and from events arising in the organisation's external environment.

There is a natural resistance to organisational change: 'old habits die hard'. After an event occurs from which change may arise, it is often very difficult to foresee what changes may result. The reaction may be to ignore the event: 'what's it got to do with me?'; it may be to absorb it while leaving the ideologies of the organisation unchanged (for example, a change in the standard rate of VAT would probably be treated in this way); the organisation may absorb the change and adjust its ideologies; or, where the organisation as a whole has avoided any reaction, the event may be absorbed by a part of the organisation and then spread from within: the 'trojan horse' effect.¹

Despite the accountant's image of being inflexible and old-fashioned, accounting has not stood still. As Hopwood et al. (1990, p. 102) state: 'accounting has not just evolved . . . [it] has responded in a more positive way to external as well as internal pressures and circumstances, internalizing into itself residues of events and disruption in the contexts in which it operates'.

Carnall sees accounting change as being in five stages: denial (why change?); defence (stall for a while); discarding (adjusting to the change); adaption

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(implementation); and internalisation (acceptance that the new way is 'normal').² This would tend to be a somewhat slow and drawn out process: hard to detect initially, but ultimately obvious. The pace of accounting change was fairly slow up until the 1970s but, fuelled by the information technology explosion,³ it is now occurring far more quickly than was previously the case.

More specifically, Hopwood (1990, pp. 12–13) states that computer-based technologies (i.e. information technology) have resulted in an amazing intensification of organisational changes; and that this has caused organisational trends (i.e. change) to be speeded up, rather than to be replaced by new ones. Further, 'the impact of new technologies on accounting is likely to be mediated and influenced by the organisational and cultural terrains into which the technologies are introduced'. Hopwood goes on to state (1990, p. 15) that: 'organisations are being changed in the name of [efficiency, value for money, cost effectiveness and the market] and . . . new calls are being made for the extension of modes of economic calculation to objectify and operationalise the abstract concepts in the name of which change is occurring. Accounting and related bodies of techniques are important means for such operationalisation'.

Information technology has, therefore, been said to be responsible for speeding-up the rate of change within accounting. Changing external and internal pressures have resulted in a higher appearance of objectivity being required when change is being considered and decisions are being made. To these two factors can be added a third: the enormous growth in management education over the last few years, particularly through the provision of MBA courses on a full-time, part-time and, distance-learning basis. Such opportunities were few and far between, now they are available throughout the United Kingdom. As a result, managers are becoming more aware of the decision aids at their disposal, and are more equipped to apply the benefits of the information technology explosion in order to meet the higher requirement for apparent objectivity that now exists.

Yet, why should such environmental changes have led to any change in accounting practices? Could existing practices not just have been refined, rather than replaced by more sophisticated ones?

Scapens (1985) implies that replacement would arise when he refers to what he calls the 'costly truth' approach: 'truth' being the accounting system that ought to be used, given all the relevant costs and benefits of doing so. He states (Scapens, 1985, p. 121) that 'the necessary information may not be available within the constraints imposed by current information technology and the ability of existing management. Furthermore, even if such information could be provided, the costs of doing so may be extremely high . . . the costs . . . should not outweigh the benefits to be obtained therefrom.' Thus, when the costs of information are higher than the benefits of using it, it is irrational to seek that information. Scapens continues (1985, p. 121): 'Simple, and sometimes apparently "unrealistic", techniques are frequently observed in practice, despite an extensive literature which provides complex, and "more realistic" alternatives

... ' (p. 128) 'The choice of a particular model will depend on the costs and benefits of that model, relative to the costs and benefits of alternative models. It would be quite reasonable for a decision maker to select a very simple model, if the costs of using the more complex alternatives exceed their benefits.'

The information technology explosion has served to reduce the costs of the provision of information. As a result, it is now rational to acquire information when previously it may not have been. That information may provide the opportunity to adopt methods and practices that were previously irrational. In addition, utilisation of increased education opportunities has had the effect of increasing the knowledge and skills of management. These two factors would suggest that the environmental changes referred to earlier could have led to changes in accounting practice. Such changes would have occurred first in those organisations which would have been the first to find that the benefits of obtaining the information deriving from such change exceeded its cost. Thus, when computers first appeared, it was only the largest companies, those who had the greatest economies of scale, who used them. Then, as costs fell in relation to computational power, more and more companies viewed them as being a cost-effective information source. Thus, information technology-led accounting change would tend to start in the largest companies and then trickle down to smaller and smaller ones until, ultimately, all companies had changed.

AREA OF INTEREST

One area where these changes may be having an effect upon accounting practice is quantitative capital investment appraisal. There have been a number of articles during the last decade concerning corporate practice in this area. Studies have been undertaken both in the UK and overseas and some attention has been given to comparisons between UK and US practice (see Mills, 1988a). In addition, attempts have been made to detect trends in the use of these techniques (see, for example, Kim et al., 1986).

In particular, much attention has been given to the use of discounted cash flow (DCF) in its principal forms of net present value (NPV) and internal rate of return (IRR). The case has often been made that companies should be using one or other of these techniques,⁴ preferably NPV.⁵ However, these are more time consuming and, therefore, more costly to use than the other principal techniques — payback and accounting rate of return (ARR). In the UK, studies have consistently shown that payback is used more often than either of the DCF techniques: a finding which is in keeping with the 'costly truth' hypothesis. The theorist's recommendation that NPV be used rather than IRR was generally found not to have been adopted (with the exception of the 1984 study by McIntyre and Coulthurst, which will be referred to later).

When Pike (1982) compared the usage of investment appraisal techniques in 1975 with that in 1980, he found that, despite evidence suggesting that the

use of the DCF techniques was being depressed by managerial ignorance (see, Pike, 1982, pp. 53–54), there was a general rise in the number of methods used, and in the use of one method in particular, namely, IRR. He suggested that the level of sophistication of the methods used was related to company size but, as his 1975 and 1980 data were derived from a questionnaire which asked for details of historic (i.e. 1975) and current (i.e. 1980) usage, this would not satisfactorily explain the changes he identified. Some other factor had to be responsible and this he provided, by implication, when he stated that an expanding firm would require to use superior investment appraisal techniques in order to handle the increasing complexities that the expansion was generating (Pike, 1982, p. 80): he took the view that expansion-led organisational change was responsible for the shift in practice between the two dates which his study considered.

When Mills and Herbert (1987) compared their 1984 data with those from other studies, including Pike's, they also found that company size was a significant factor in the range and type of technique used. They did not consider the possibility that organisational change over time could have contributed to the differences they detected, preferring rather to treat all the data as contemporary. On the basis of Pike's findings, it may be that this was inappropriate: their analysis may have been affected by the undetected influence of organisational change upon the choice of techniques selected.

In response to a question concerning future changes, Pike's survey respondents made reference to wider use being made of computers (see Pike, 1982, pp. 78–9). As those respondents had anticipated, information technology developed extensively during the 1980s. This had not been difficult to foresee in 1980/81 as these developments had been having a marked impact upon working practices since 1975.⁶ In 1979, the first electronic spreadsheet (Visicalc) was introduced and many others followed. These have been regularly enhanced since they first appeared in order to make use of the vast increase in computing power that has arisen since the Apple microcomputer was introduced in 1977 and, given the benefits to be derived and the awareness that Pike identified, it is reasonable to suppose that corporate practice in the area of capital investment appraisal reacted accordingly. For example, it is likely that the use of the IRR technique, which is many times easier to apply using a computer than manually, will have risen during the five years or so since this was last examined. The impact of organisational change over time upon technique selection should be more apparent than ever before, and should be detectable where results contradict the earlier findings on size.

Thus, earlier studies had suggested three possible causes for differing organisational practices in this area: company size, managerial knowledge, and organisational change arising from expansion. As stated previously, organisational ideologies and mores will affect the impact of new technologies on accounting but, it could be argued, this will only hold in the short-term. In the longer-term, the 'trojan horse' effect referred to in the introduction will

overcome these restraints and, ultimately, the new technologies will be fully utilised by all: ultimately, the only ones not using the more sophisticated techniques will be those who perceive that they have no need to do so. If that is the case, the impact of size upon the choice of appraisal criteria may be becoming far less apparent than previously. Also, if managerial knowledge is being improved through more education of managers, then this may lead to current criteria selection being more theoretically sound than in the past.

With this in mind, it was decided to conduct two surveys of current practice in companies operating in Scotland: one covered '*large*' companies, the other '*small*', their relative size being on the basis of turnover.⁷ The survey sought to answer the following questions:

1. What is the current usage⁸ of the four most commonly cited quantitative methods of capital investment appraisal — payback, IRR, NPV and ARR?
2. What changes have occurred in usage since the date of the last studies?
3. Do larger companies make greater use of the more sophisticated DCF techniques than smaller companies?
4. Is ARR maintaining its popularity despite its theoretical deficiencies?⁹

This paper considers the data derived from the '*large*' Scottish company study and relates them to the earlier larger company studies of Mills and Herbert, Pike, and the earlier smaller company study of McIntyre and Coulthurst. It seeks to show that earlier findings suggesting a relationship between size and the method of capital appraisal selected may now only be valid when the size difference is great, and should only be valid when the studies compared are contemporaneous. It suggests that information technology-led organisational change may have eroded this previously established relationship, and that it is likely to continue to do so. The '*small*' Scottish company study¹⁰ comprised companies which were smaller than those studied by McIntyre and Coulthurst. Where appropriate, the data from it have been included in order to enhance the comparison between the (larger company-based) '*large*' Scottish company study and that of the (smaller company-based) study conducted by McIntyre and Coulthurst (1985).

SURVEY METHOD AND DISCUSSION OF THE RESULTS

The survey, carried out in Spring 1989, involved the largest companies (on the basis of turnover) registered and operating in Scotland: they were identified in the 1987 volume of Jordan's '*Scotland's Top 500 Companies*'. Turnover ranged from £5m to £2bn and the number of employees from 11 to over 41,000. As originally defined in the 1985 Companies Act (Section 248),¹¹ the majority were large firms, 14.8 per cent being medium-sized and 0.6 per cent small. Of the respondents, 42 per cent classified themselves as manufacturing

Table 1
Comparative Sizes of the Study Populations

<i>Criterion:</i>	<i>Capital Expenditure</i>	
	<i>Mills & Herbert (1984)</i> %	<i>Pike (1980/1)</i> %
Large	26	15
Medium	18	14
Small	56	71

<i>Criterion:</i>	<i>Turnover</i>	
	<i>Mills & Herbert (1984)</i> %	<i>Current Study (1989)</i> %
Large	27	1
Medium	27	2
Small	46	97

<i>Criterion:</i>	<i>Companies Act Definition (indexed)^a</i>	
	<i>Current Study (1989)</i> %	<i>McIntyre & Coulthurst (1984)</i> %
Large	81	—
Medium	18	100
Small	1	—

Note:

^a See note 11.

companies, with the next most common classifications being distribution (13 per cent) and engineering (11 per cent).

A total of 491 questionnaires were sent and 107 were returned completed, of which 94 were usable: this represents a response rate of 21.8 per cent which compares favourably with the 18.8 per cent achieved by McIntyre and Coulthurst (1985) in their 1984¹² survey of medium-sized British companies.

As has commonly been found with surveys in this field (see Mills, 1988b), the results are not directly comparable with others previously reported. The sample surveyed in each case comes from a different population. For example, 81 per cent of the companies included in the current study¹³ were larger than those of McIntyre and Coulthurst who used a sample of 'medium-sized' companies as defined in the Companies Act 1981.¹⁴

The 1980/81 study of Pike (1982), which covered the change in practices between 1975 and 1980/81, was based on the top 300 UK companies measured by market capitalization. In the analysis of their 1984 study, Mills and Herbert (1987, pp. 14–15), in an attempt to enable greater comparisons to be made

Table 2

Significance Levels for Differences Between the Earlier Studies Usage of DCF Techniques (Based on a One-tailed Test of Proportions)^a

	<i>Mills/ Herbert (1984)</i>	<i>Pike (1980/1) (1975)</i>	<i>McIntyre/ Coulthurst (1984)</i>
IRR	99 % _____	99 % ^b	
	99.9 % _____	99.9 %	
	99.9 % _____		99.9 %
		95 % _____	
		99.9 % _____	99.9 %
			99 % _____
NPV	95 % _____	95 %	
	99.9 % _____	99.9 %	
	99 % _____		99 %
DCF	n/a ^c		
		99.9 % _____	99.9 %
		95 % _____	95 %

Notes:

^a H1: larger companies make greater use of IRR/NPV/DCF techniques in general.

^b For IRR usage, there is a 99 per cent significance level of difference between these two studies.

^c No data is available on this for the Mills and Herbert study.

between their survey results and others, used three different criteria to define company size: capital expenditure; turnover; and profit before interest and tax.¹⁵ Table 1 shows how the various studies can be compared in terms of company size using the first two of these criteria and the Companies Act definition.¹⁶

On the basis of the data contained in Table 1, it appears that Mills and Herbert's companies were relatively larger than those of Pike; both Pike, and Mills and Herbert, were dealing with larger companies than those in the current survey, and McIntyre and Coulthurst with smaller ones. It has been suggested by Pike and by Scapens et al. (1982) that there is an association between company size and the use of DCF techniques. This was confirmed by Mills and Herbert (1987, pp. 74–77) and is supported by McIntyre and Coulthurst's results. Table 2 shows the significance levels for differences in the usage of DCF techniques between the earlier studies (based on a one-tailed test of proportions).¹⁷ The percentages appearing at the ends of each horizontal line give the level of statistical significance found between the two study groups concerned for the method being reported. It confirms these earlier findings and seems to suggest that the relationship is stronger in respect of IRR, than with NPV.

Table 3
Usage of Quantitative Evaluation
Methods Found in the Current Scottish
Large Company Study

	%	Rank
IRR	58	2
NPV	48	3
Payback	78	1
ARR	31	4
DCF	73 ^a	

Note:

^a NPV but not IRR [15 per cent] + IRR but not NPV [25 per cent] + both NPV and IRR [33 per cent] = 73 per cent.

If there had been no change through time in the choice of approaches adopted, it would be expected that use of DCF techniques, particularly IRR, would be lower, whether as a primary¹⁸ or secondary method, in the current study than in the case of Pike and (more markedly) of Mills and Herbert, as the current study companies are smaller. On the same basis, as the current study companies are larger than those in the McIntyre and Coulthurst study, use of DCF techniques would be expected to be higher in the former than in the latter.

Analysis of the data from the earlier studies revealed a statistically significant difference in the application of NPV between the large company study of Mills and Herbert and two smaller company studies: Pike (both data sets) and McIntyre and Coulthurst.

A comparison of the results from the two current Scottish studies revealed no significant difference in the frequency of usage of NPV between the large and small companies. It could be argued that the Scottish studies findings show that size may no longer have the major impact upon organizational practice that the above analysis of the earlier study data revealed. More specifically, as the relative size of the companies in the McIntyre and Coulthurst's 1985 study lies between those of the two Scottish studies: it may be appropriate to suggest that the 'size factor' is not relevant to any comparison of the use of NPV between the findings of McIntyre and Coulthurst and the current study. If this is the case, it may be that any differences between the current study and the earlier ones could be due, in part at least, to the impact of organisational change over time upon the choice of techniques selected.

Table 3 shows the proportion of companies in the current study using the main quantitative methods of investment appraisal, and their ranking.

Table 4

Usage of Quantitative Evaluation Methods: Comparison with Other Studies

	<i>Current Study 1989 %</i>	<i>McIntyre/ Coulthurst 1984 %</i>	<i>Mills/ Herbert 1984 %</i>	<i>Pike 1980/1 %</i>	<i>1975 %</i>
IRR	58	28	68	54	42
NPV	48	36	51	38	32
Payback	78	82	78	79	71
ARR	31	33	44	51	51
DCF	73	45	—	69	60
Other	2	4	—	7	5
None	8	0	—	0	4

As can be seen, the most popular of these four methods is payback with 78 per cent usage among the companies. It is used by 34 per cent¹⁹ more companies than IRR, the second most popular method. However, payback is used by only seven per cent more companies than DCF techniques in general (NPV, or IRR, or both). Table 3 is expanded in Table 4 to include the findings of the three earlier studies.

Comparison of the current study with McIntyre and Coulthurst's results in Table 4 reveals a statistically significant difference (based on a one-tailed test of proportions, at the 99.9 per cent confidence level) in the usage of the more sophisticated IRR technique. Table 5 shows the data and levels of significance of difference in respect of the McIntyre and Coulthurst study and both the large and small current company studies.

As can be seen, a statistically significant difference (at the 99 per cent confidence level) was found in the frequency of usage of IRR among the companies in the current study and those drawn from a population of companies smaller than those in McIntyre and Coulthurst's study (i.e. those in the Scottish small company study). This would seem to confirm that size is a relevant factor. Yet it is interesting to note that usage in the Scottish small company study was higher than in that of McIntyre and Coulthurst, and the degree of significance was lower (99 per cent as opposed to 99.9 per cent) — despite the McIntyre and Coulthurst study comprising larger companies. In addition, no statistically significant difference was found in the usage of NPV between the Scottish small company study and either of the others, yet, there is evidence of a statistically significant difference between the Scottish large company study and that of McIntyre and Coulthurst. On the basis of that result, it can be suggested that size may be a less significant factor than was previously the case. The difference in the usage of these techniques between the Scottish small

Table 5

Evaluation Methods Used: Comparison Between the Two Scottish Studies and that of McIntyre and Coulthurst

	<i>Current Large Company Study (1989) %</i>	<i>McIntyre/ Coulthurst (1984) %</i>	<i>Current Small Company Study (1989) %</i>
IRR	58	28	39
significance: ^a	99.9% _____	99.9%	99%
	99% _____		
NPV	48	36	42
significance: ^a	95% _____	95%	
Payback	78	82	56
significance: ^b	99% _____	99.9% _____	99.9%
			99%
ARR ^c	31	33	26
DCF	73	45	54
significance: ^a	99.9% _____	99.9%	
	99% _____		99%

Notes:

^a One-tailed test, H1: larger companies make greater use of IRR/NPV/DCF techniques in general.

^b Two-tailed test H0: there is no significant difference in proportionate usage of a method between the studies.

^c A two-tailed test of proportions revealed no statistically significant difference between these three studies in the usage of ARR.

A one-tailed test was used for the tests on IRR, NPV, and DCF as previous study findings had suggested that there may be a relationship between company size and technique selection. A two-tailed test was used to test the other methods as no such evidence existed to justify use of a one-tailed test.

company study and that of McIntyre and Coulthurst, might be ascribed to the impact of organisational change over the five years between the two studies: any previous effect of size having been reduced (IRR) or eliminated (NPV), as usage is greater in the former than in the latter, larger company-based study.

Size could, therefore, be held to have less relevance than was previously the case. Table 6 shows the results of one-tailed significance tests upon the differences between the earlier studies and the current Scottish large company study in respect of their usage of the DCF techniques.

Consideration of the results contained in Table 6 suggests that the use of IRR is no longer related to company size for companies of relative sizes ranging from that of the current study to that of Mills and Herbert's study. Size may remain a significant factor between companies from within that range and those smaller than it, though the previous analysis of the data from the Scottish small

Table 6

Significance Levels for Differences Between the Current Study and Each of the Earlier Studies in Respect of Usage of DCF Techniques (Based on a One-tailed Test of Proportions)^a

	<i>Mills/ Herbert (1984)</i>	<i>Pike (1980/1) (1975)</i>	<i>Current Study (1989)</i>	<i>McIntyre/ Coulthurst (1984)</i>
IRR			99.9% _____	99.9%
NPV			95% _____	95%
DCF	n/a ^b		99.9% _____	99.9%

Notes:

^a H1: larger companies make greater use of IRR/NPV/DCF techniques in general.

^b No data is available on this for the Mills and Herbert study.

company study has suggested that any remaining relationship is weaker than was previously the case.

The NPV result also suggests that size may no longer be relevant to its selection. As Table 2 showed, there was a statistically significant difference between the Mills and Herbert study and both the Pike data points, but only at the 95 per cent level for the Pike 1980/81 data, as opposed to the 99.9 per cent level for the 1975 data: clearly this suggests that, even then, the impact of size was diminishing. Table 2 also revealed a statistically significant difference between the Mills and Herbert and McIntyre and Coulthurst studies which were both conducted in 1984. The relative difference in company size was marked and the result suggests that, for relative size differences of that magnitude, size was relevant to the choice of method made at that time. No statistically significant difference in usage of NPV between the Scottish small company study and any of the others was identified. This seems to suggest that there is now a different relationship between the use of NPV and company size from that previously reported. It may be that no relationship exists or, more plausibly, that the level of usage in each of the company size groupings has changed. Whichever is the case, any differences detected between the current and previous studies in the use of NPV is due to factors other than size, most likely arising out of the impact of organisational change over time.

DCF usage is derived directly from the usage of IRR and NPV. As a result, Tables 2, 5, and 6 reveal a similar picture for DCF to that they portray for these techniques individually.

If DCF techniques have previously been found to be used more by larger companies, it may be that the other techniques have previously been used more by smaller ones. This is supported by consideration of the Pike study data in Table 4 regarding payback. In the case of ARR, when comparing their results

Table 7

Significance Levels for Differences Between the Studies' Usage of Payback and ARR (Based on a Two-tailed Test of Proportions)^a

	<i>Mills/ Herbert (1984)</i>	<i>Pike (1980/1) (1975)</i>	<i>Current Study (1989)</i>	<i>McIntyre/ Coulthurst (1984)</i>
Payback		95 %		95 % ^b
ARR	95 %		95 %	
		99 %	99 %	
		99 %		99 %
		99 %	99 %	
		99 %		99 %

Notes:

^a H0: there is no significant difference in proportionate usage of a method between the studies.

^b For Payback usage, there is a 95 per cent significance level of difference between these two studies.

with those of Pike, Mills and Herbert found that smaller firms (Pike's) used ARR more than larger ones (Mills and Herbert's). In their 1980 survey, Scapens et al. found that ARR was ranked lower in large companies and, when Mills and Herbert (1987, p. 23) compared their study (which involved relatively larger companies) to that of Scapens et al., they found that ARR was more popular with companies in the latter study. In order to determine whether such a relationship can be supported by the data, a one-tailed test of proportions on the differences between the studies' usage of payback and ARR was conducted. It revealed no statistically significant differences in the usage of ARR, and only one in respect of payback: at the 95 per cent level between the Pike 1975 data and that of McIntyre and Coulthurst. Were size a factor in determining the usage of payback then it would surely have been evidenced by the existence of a statistically significant difference between the usage of payback reported by the contemporaneous McIntyre and Coulthurst and Mills and Herbert studies. That none was found suggests that, as with ARR, there is no inverse relationship between company size and the usage of payback.

Examination of the data in Table 4 does suggest, however, that there may be statistically significant differences between the usage of these techniques among the studies. A two-tailed test of proportions on the differences in usage of payback and ARR was carried out. Table 7 shows the result.

The previously held view that size and the use of ARR are inversely related, would suggest that the current study, which dealt with smaller companies than those of Pike and Mills and Herbert, would have found ARR to have been used more than in either of these studies. The fact that the opposite was found (see Table 4), and that the difference found is statistically significant between

the current and Pike studies (see Table 7), would seem to suggest that there has been a marked decline in the popularity of ARR since 1980. It also suggests that some of the difference between the 1980/81 and 1984 studies could have been due to the impact of organisational change rather than merely to company size, as was suggested by Mills and Herbert.

Payback usage is only statistically significantly different in one case: between the Pike 1975 data and that of McIntyre and Coulthurst. As had been found using a one-tailed test of proportions, the result shows a 95 per cent level of significance. Consideration of the result from the Scottish small company study (given in Table 5) indicates that size is probably a factor, but in the opposite direction to that suggested by the Pike 1975 data. Payback is the most used method within the Scottish small company study, but, as with all the methods, it is less used by the companies in that study than by those in the Scottish large company study. It may be that previous analysis, which suggested the existence of a relationship between size and usage, may no longer be applicable to companies of size ranging from those in the McIntyre and Coulthurst study to those in the study by Mills and Herbert. It seems that size is a factor when considering difference in usage of payback between companies lying within that size range and smaller ones, but that it is a positive relationship, rather than the inverse one previously suggested.

Thus, analysis of the data in Table 4 leads to the conclusion that there appears to have been an erosion in the impact that company size has upon the selection of appraisal criteria: there may have been a 'trickle down' effect — the largest companies used the more sophisticated techniques first, then the next largest, then the next largest, etc. There is far greater usage of the DCF techniques evidenced by the current study than would have been the case had the size relationship been as before and nothing else changed. There is also far less usage of ARR than would have been suggested by the findings of previous studies relating size to usage. These results suggest that companies have been experiencing organisational change of a type which has led to a change in the selection of appraisal criteria. The hypothesis that this change may be derived from the information technology explosion of the last decade, along with an improvement in the general level of education of decision makers, matches these results and would account for the changes identified. These changes would apply to all companies and it is probable that usage has also changed in companies of the size studied by Mills and Herbert, and Pike. Indeed, this would need to have happened if size is still a relevant factor in the selection of appraisal criteria by the larger company. This analysis of the current study results suggests that size difference cannot explain differences in criteria selection between it and the earlier studies. A survey of companies of the size of those studied by Mills and Herbert will be required before this point can be determined.

While the selection of those appraisal methods which a company may apply appears to have changed since the earlier studies were undertaken, this will have had a major impact on the decisions being made only if the change is

Table 8

Comparisons of Primary Quantitative Method Usage (Using a Two-tailed Test of Proportions)^a

	<i>Current Study 1989 %</i>	<i>Mills/ Herbert 1984 %</i>	<i>Pike 1980/1 %</i>
Payback	48(1) ^b	38(2)	32(2 =)
significance:	95 %		95 %
IRR	23(2)	43(1)	41(1)
significance	99 %	99 %	99 %
NPV ^c	17(3)	21(3)	17(4)
ARR	14(4)	20(4)	32(2 =)
significance:	99.9 %	95 %	99.9 %
			95 %
	<u>102^d</u>	<u>122^d</u>	<u>122^d</u>

Notes:

^a H0: there is no significant difference in proportionate usage of a method between the studies.

^b The number in brackets indicates the primary ranking of each method.

^c No statistically significant difference was found between the ranking of NPV in these three studies.

^d The totals exceed 100 because some companies ranked more than one method first.

reflected in the primary (i.e. most important) method applied. This is the method which has the greatest impact when vetting an investment proposal. It will often be the first whose results are consulted, leading to preliminary acceptance/rejection. It may be the only method used in many instances as the project which 'fails' according to the method's criteria may be discarded prior to its being reviewed in terms of other methods. Only those projects which are acceptable under the primary method may be subject to analysis by any other. Even where other methods are applied concurrently with, or before the primary method, it will be the latter which determines whether the project should be considered. The proportionate selection of primary method is shown in Table 8.

It can be seen that the choice in the current study is different from that in the others. Indeed, the difference between the current study and that of Pike is statistically significant, using a two-tailed test of proportions, at the 99 per cent level for IRR, 99.9 per cent for ARR and 95 per cent for payback. The IRR difference identified between the current and Mills and Herbert studies is statistically significant at 99 per cent. The current study found that more than twice as many companies ranked payback as the primary method as any

other method. IRR, which was the most popular primary method in the other studies, was found to be in second place. It may be that this difference in ranking between payback and IRR is due, in part, to the difference in company size: the relatively smaller companies in the current study preferring to use the 'cheaper' payback technique rather than the more sophisticated IRR technique.

The analysis of the data in Table 4 suggested that IRR is being used more by companies than was previously the case. The data in Table 8 suggests that this change in usage may have involved IRR being used as a secondary method where previously it was not used at all.

The different primary usage of ARR shown in the Mills and Herbert and Pike surveys (20 and 32 per cent respectively) was attributed to different relative company size (see Mills and Herbert, 1987, pp. 26–27). When comparing their results with those of Pike, Mills and Herbert found that smaller firms (Pike's) gave ARR primary ranking more often than larger ones (Mills and Herbert's). These earlier findings suggested that size and the use of ARR as a primary method are inversely related. A one-tailed test of proportions supported this hypothesis at the 99 per cent confidence level for the difference between ARR ranking in the Pike, and Mills and Herbert studies. On that basis, the current survey, which dealt with smaller companies than the others in Table 8, would have found ARR to have been used more as a primary method than in either of the other two studies. The fact that the opposite was found, and that the difference was statistically significant, would suggest confirmation of the conclusion reached upon consideration of the results shown in Table 7: that there has been a marked decline in the popularity of ARR since 1980. Again, it may suggest that some of the difference between the 1980/81 and 1984 studies could have been due to the impact of organisational change rather than merely to company size, as was suggested by Mills and Herbert.

The Scottish small company study also found that payback had the highest primary ranking (42 per cent). McIntyre and Coulthurst's study involved the smallest companies of all the other studies. It does not include information on primary method selection. However, in those companies which use a single criterion only, they found that payback was most frequently used. Payback was the second most popular primary method identified by Mills and Herbert and Pike (though it was the most popular overall method in both these studies: see Table 4). This seems to suggest that payback is more likely to be the primary method in smaller companies, than in larger ones.

When decision makers claim to use more than one method, it is the primary method which is used to perform the initial vetting of the proposal. The other methods being applied, as appropriate, either to perform further vetting, or to provide further analysis which can be added to that resulting from the primary method analysis. For example, a decision maker whose primary and secondary methods were NPV and payback respectively, may vet the proposal using NPV and, if acceptable, then check that it was within his payback criterion of, for

example, payback within three years. Were the importance of the two methods to be switched, for example, as a result of a change in company policy arising out of an increase in interest rates, then the sequence of application would be reversed. The lower the importance rating of a criterion, the less it would be applied in the appraisal process: only being used when circumstances required. For example, if ARR is ranked fourth it would probably only be used when the other criteria were unable to differentiate between mutually exclusive alternatives. Even where the primary method is not the first applied, by definition, it will always have precedence over the other methods in determining acceptance/rejection.

Thus, the key in any combinatorial application lies mainly in the selection of primary method. The lower the importance placed upon a criterion within a combination of criteria, the less its impact will be upon the appraisal process. Nevertheless, all criteria included in a combination will be applied when appropriate and their selection within that combination indicates that some faith is placed in their ability to assist in the appraisal process.²⁰ The use of more than one criterion is indicative of caution. Prudence would suggest that the more methods used in the appraisal process, the better, because the possibility of an inappropriate decision being taken is reduced as the number of checks implemented is increased. Organisations are changing: they are becoming more sophisticated, have available a vastly improved range of decision making aids, and their managers are becoming better educated. It is possible that, as a consequence of these organisational changes, criteria are now being applied, where previously they were not (see the previous discussion regarding primary method selection of IRR), and that greater care is now being taken to ensure that the most appropriate decisions are taken. The usage of the various combinations of the four main methods is shown in Table 9.

Analysis of this table revealed a statistically significant difference in the number of methods used by companies between the current study and that of McIntyre and Coulthurst (using a two-tailed test of proportions, at the 99 per cent level for two or more methods, and at the 99.9 per cent level for three or more methods). A similar result was found between the Pike 1980 data and the McIntyre and Coulthurst study, though the significance levels were switched to 99.9 per cent and 99 per cent respectively for the two-or-more and three-or-more method sets. No statistically significant difference was found between the current study and either of the Pike study dates. Nor was any found between the two Pike study dates.

In the current study, 23.5 per cent of the firms surveyed are shown to use a single evaluation method, the main method, as in Pike's 1980/81 study, being payback. The use of two methods at 25.5 per cent is considerably lower than that found by Pike (37 per cent) and, whereas he found that a combination of payback and ARR was as popular as one of payback and IRR, only the latter combination is found to be a popular choice in the current study. It is interesting to note that nothing was found in the current survey to substantiate

Table 9

Comparisons of the Frequency of the Use of Combinations of the Quantitative Evaluation Methods

	<i>Current Study 1989 %</i>	<i>McIntyre/ Coulthurst 1984 %</i>	<i>Pike 1980/1 %</i>	<i>1975 %</i>
No Method	<u>8</u>	<u>0</u>	<u>0</u>	<u>4</u>
Single Method				
Payback	14	37	11	12
ARR	2	4	8	14
IRR	4.5	2	4	6
NPV	<u>3</u>	<u>4</u>	<u>3</u>	<u>1</u>
	<u>23.5</u>	<u>47</u>	<u>26</u>	<u>33</u>
Two Methods				
Payback + ARR	3	12	12	10.5
Payback + IRR	13	5	12	10.5
Payback + NPV	6.5	10	6	5
ARR + IRR	2	—	3	1
ARR + NPV	1	2	1	2
IRR + NPV	<u>—</u>	<u>2</u>	<u>3</u>	<u>3</u>
	<u>25.5</u>	<u>31</u>	<u>37</u>	<u>32</u>
Three Methods				
Payback + ARR + IRR	5.5	2	10	7
Payback + ARR + NPV	4.5	2	6	6
Payback + IRR + NPV	20	5	10	8
ARR + IRR + NPV	<u>1</u>	<u>—</u>	<u>1</u>	<u>1</u>
	<u>31</u>	<u>9</u>	<u>27</u>	<u>22</u>
Four Methods				
Payback + ARR + IRR + NPV	12	13	10	9

McIntyre and Coulthurst's findings that NPV was more popular than IRR and that a combination of payback and NPV was a popular choice when two methods only were used. (Theirs was the only UK survey to have found this.)

The trend shown between Pike's two time points, whereby the use of two methods rose from 32 to 37 per cent, is clearly reversed and replaced by a shift towards the greater use of three and four methods. Analysis of the three-method use reveals a higher result in the current survey than in Pike's 80/81 data (31 per cent as against 27 per cent) and a clear change in emphasis with one combination, payback with IRR and NPV, being almost four times more common than any of the others. Pike had found this combination to be of equal

Table 10

Methods Adopted in Multiple Usage Companies:
Comparison of Study Results

	<i>Current Study 1989 %</i>	<i>McIntyre/ Coulthurst 1984 %</i>	<i>Pike 1980/1 %</i>
Payback	94	94	89
ARR	42	57	57
IRR	78	51	66
NPV	66	64	51
DCF	95	77	85

frequency with that of payback with IRR and ARR. This again points to the reduction in the usage of ARR which was identified earlier.

One difference between the current survey and that of McIntyre and Coulthurst is striking. Their survey showed that 47 per cent of companies used a single method, compared to half that number (23.5 per cent) in the current study. (A two-tailed test of proportions found this to be statistically significant at the 99.9 per cent level, as was the difference in the levels of three method usage between these two studies.) This difference could be due to the different relative size of the companies in the two surveys but, as 18 per cent of the companies in the current survey were of the same relative size as the McIntyre and Coulthurst companies, this hypothesis would require that only 18.34 per cent of the other companies in the current survey used a single method.²¹ The Scottish small company study found 28 per cent usage of a single method and this would seem to confirm that, during the five years which have elapsed since the McIntyre and Coulthurst survey was undertaken, companies have increased the number of methods they apply — i.e. more data are now being generated to be used in the capital investment decision making process than was previously the case.

Table 9 also reveals that the position regarding ARR shown in Table 4, whereby the usage of ARR remained virtually unchanged between McIntyre and Coulthurst's study and the current one (33 and 31 per cent respectively), concealed the true picture. It is virtually unused by companies using a single method and only 25 per cent²² of those using two methods are found to include it: this compares with 44 per cent of companies using two methods in the McIntyre and Coulthurst study and 42 per cent of those using two methods at both the Pike study dates. It is used now mainly in combination with two,

Table 11

Method Usage Comparison: Multiple Usage Companies (m)
and Single Usage Companies (s)

	<i>Current Study 1989</i>		<i>McIntyre/ Coulthurst 1984</i>		<i>Pike 1980/1</i>	
	<i>m %</i>	<i>s %</i>	<i>m %</i>	<i>s %</i>	<i>m %</i>	<i>s %</i>
Payback	94	59	94	77	89	44
ARR	42	9	57	9	57	31
IRR	78	18	51	5	66	15
NPV	66	14	64	9	51	10
DCF	95	32	77	14	85	26

or all three of the others. Thus, while its overall usage is not statistically significantly different between the current and McIntyre and Coulthurst studies, the way in which it is used has changed.

The proportional usage of the four main methods by companies which apply more than one method is shown in Table 10.

It reveals that those companies using more than one of these methods — 69 per cent²³ (1989); 52 per cent (1984); and 74 per cent (1980/81) — appear to be making greater use of NPV (29 per cent increase since 1980/81), IRR (18 per cent), DCF in general (12 per cent) and payback (6 per cent), and less use of ARR (26 per cent decrease). Payback seems to have established itself as virtually a mandatory method whenever more than one method is to be used: this is a not unexpected situation given its historical popularity, its simplicity and the increasing awareness of the importance of cash flow management in business today.

Table 11 expands on the analysis of Table 10 to show the comparison between those companies that use more than one method, and those that use a single one.

All three studies show that companies which use more than one of these methods make far greater use of the DCF techniques than those that restrict themselves to one method only. (The current study shows, for the first time, that DCF among companies using multiple methods is more popular than payback, though only just and certainly not significantly so.) Such a result is only to be expected if it is assumed that lack of the use of multiple methods is partly due to an unwillingness to apply the more sophisticated methods; that is to say, the likelihood that more sophisticated methods will be used increases as more methods are used in combination. The increase in usage of these techniques is also not unexpected in the light of the growth in the availability

and sophistication of computer spreadsheet packages, capable of easily performing whatever data analysis decision makers choose. Prior to 1979, such analysis was typically performed by hand. It was time consuming, repetitive, tedious to produce, and prone to error. There was considerable disincentive to apply DCF techniques and evidence exists that suggests that managers were also rejecting these techniques because of ignorance surrounding their application and suitability (see Pike, 1982, pp. 53–54). It is not surprising, now the psychological and educational barriers to their use have been removed and lifted, that the application of DCF techniques appears to be increasing.

Table 11 also suggests that even the companies using a single method might be moving towards the more sophisticated methods. A comparison between the current survey and that of McIntyre and Coulthurst reveals a difference in single method usage which cannot be entirely due to the difference in the relative sizes of the companies. The difference in single method usage between the current study and Pike's cannot be the result of company size difference as the change in the usage of DCF techniques is an increase, not a decrease on that shown by Pike.

SUMMARY OF FINDINGS

The current survey set out to examine the usage of quantitative techniques for capital investment appraisal in Scotland's largest companies and the results can be summarised as follows:

1. payback is the most popular method, then IRR, followed by NPV and, finally, ARR;
2. DCF techniques are almost as widely used as payback and, in companies using more than one of the four methods, the DCF approach may be more popular than payback;
3. IRR is more popular than NPV despite the theoretical superiority of the latter;
4. over 40 per cent of the companies surveyed use three or four methods;
5. ARR is mainly used with other methods: it is used by only nine per cent of those companies using a single method.

Comparisons with earlier studies suggest that:

- (a) ARR is being used less than previously;
- (b) DCF techniques are gaining in popularity;
- (c) NPV is increasing in popularity at a faster rate than IRR;
- (d) payback is consolidating its position as the most used of the four methods;
- (e) individual companies are using more of the methods than previously;
- (f) Mills and Herbert's findings that there is some association between size and the use of DCF techniques were not borne out by the current study: it appears that there has been an increase in usage among smaller

companies which has resulted in the erosion of this previously identified relationship;

- (g) previous findings that suggested an inverse relationship existed between size and the use of ARR may no longer be valid.

So far as these findings are concerned: the reasons why payback remains popular despite its theoretical limitations have been covered elsewhere, both empirically (see, for example, Pike, 1982) and theoretically (see, for example, Van Horne, 1986, p. 130). The decline of ARR has been advocated for some time. The only surprise is that its demise has taken so long to come about. Although almost one third of the companies surveyed continue to use it, they do so more as an additional criterion measure rather than as the principal criterion. The move towards increased use of DCF techniques was expected. The fact that there is also evidence of a possible shift in emphasis towards NPV suggests that rather more than simply organisational change fuelled by the growth of information technology is the cause. A change in attitude towards the more theoretically sound of the DCF techniques would seem to indicate that managers are becoming more aware of the theoretical advantages of NPV, in relation to IRR. If one accepts that the theoreticians are correct, the quality of managerial decision making should be being enhanced as a result.²⁴

CONCLUSIONS

As already stated, comparisons with other studies in this area are difficult. All the studies are different in terms of the method of analysis used, the population sampled, and, to a lesser extent, the questions asked.²⁵

Mills and Herbert were at least partially successful in their attempt to overcome these difficulties through the alignment of their survey research to that of Pike and of Scapens and Sale (1981). While direct comparison between the survey results remained imprecise, they were able to adopt the size definitions applied to test for association between company size and the use of DCF techniques for their own survey data and thereby confirmed the previous studies' findings. However, it was not possible to eliminate overlap of size between the studies (see Mills and Herbert, 1987, p. 14) and it therefore proved impossible for them to state more than that one study concerned *proportionally* larger companies than another. In addition, they failed to undertake much of the analysis performed in the other studies (for example, the data contained in Table 9 above).

This analysis has attempted to overcome these difficulties by identifying where each study lies in a company size continuum ranging from the largest (Mills and Herbert) to the smallest (McIntyre and Coulthurst) — see Table 1 — and then repeating previously reported tests on the data from these past and the current studies. The relationship between size and technique selection previously identified was not disputed, except where evidence exists to challenge the hypothesis, as in the comparison between the current and McIntyre and

Coulthurst studies. Pike had suggested that organisational changes had occurred between 1975 and 1980/81. The later studies had ignored this factor, preferring to pursue the size hypothesis. This study reopens the question of the impact of organisational change upon the choice of technique selected. It has tested the accepted size hypothesis in order to demonstrate that technique selection has changed, and that such change could be the result of information technology led, and 'costly truth' motivated, organisational change. In doing so, it has shown that the situation has changed, for otherwise the size hypothesis could never have been valid: companies of the size examined in the current study are using more sophisticated techniques, more techniques overall, and are making less use of the less theoretically valid ARR technique than would have been expected from the results of earlier studies.

Conclusions drawn can only be directly related to companies of the size the current study examined and, until one of the studies is repeated using similar survey populations, questions *and* analysis methods, conclusions cannot be drawn regarding changing attitudes and practices of companies outwith the size covered in the current study. Nevertheless, it is illogical to suggest that such change will not have occurred. The inference from the current study results is that change has probably occurred in companies of all sizes. However, the exact nature of that change will remain unknown until further research is carried out.

It is plausible that these changes are the result of the expansion of facilities based on information technology (i.e. computers and computer packages), for this is an area of management decision making which ideally lends itself to these developments. It is also possible that the growth in management education in recent years has led to the more theoretically sound techniques being adopted to a greater degree than previously, particularly in response to the increased need to appear to objectify decisions of this type. Whatever the cause, it is clear that there has been a change and that there is a move towards greater use of the more sophisticated techniques. It also appears that the earlier work on the impact of size may have been subject to organisational change between the various survey dates. It would seem that further research in this area would be appropriate, particularly as the vastly reduced cost of hardware and software has, among other things, made the use of DCF techniques a relatively straightforward task for even the smallest of companies. A facility which may eventually contribute to the complete erosion of the relationship between size and the selection of quantitative appraisal techniques.

NOTES

- 1 For a fuller analysis, see Laughlin (1991).
- 2 For a fuller analysis see Carnall (1990, p. 141).
- 3 The information technology industry has been improving its fundamental technological cost performance at 30 to 40 per cent compound annually for the last thirty years — see Benjamin

and Scott Morton (1988). This has contributed to an enormous growth in the use of information technology over that period. This growth can be illustrated by findings such as those of Gurbaxani and Mendelson (1990) who found that data processing expenditure in the US (in 1972 dollars) rose from \$30 billion in 1975 to \$59 billion in 1987 — allowing for a 30 per cent compound cost performance growth factor, the 1987 figure bought the performance equivalent of \$1,375 billion in 1975, i.e. a 45-fold purchased performance growth over the actual 1975 purchase. Of more direct relevance to the current study, Brancheau and Weatherbe's (1990) study of spreadsheet adoption among 500 professionals working in corporate finance and accounting departments showed a rise in usage of over 900 per cent, from a base of 35 users in 1981 to over 300 in 1987.

- 4 See, for example, Merrett and Sykes (1973, pp. 92–102).
- 5 See, for example, Levy and Sarnat (1986, p. 90).
- 6 See, for example, Hopwood et al. (1990, p. 69).
- 7 When the words 'large' and 'small' are used to differentiate the two Scottish studies, it is purely in the dictionary sense; there is no intention to suggest any more than that, on the basis of turnover, the companies in the 'large' study were larger than those in the 'small' study.
- 8 The aim was to determine overall usage, rather than specific usage in relation to, for example, types of investments, ranges of funding, or levels of risk.
- 9 See, for example, Ross and Westerfield (1988, pp. 282–84).
- 10 The companies in the Scottish 'small' company study were all drawn at random from a population comprising companies which would be defined as 'small' under the Companies Act definition (see note 11 for details of this definition). A total of 303 questionnaires were sent, of which 68 useable returns were received: a response rate of 22.4 per cent.
- 11 When a company satisfies two or more of the conditions relating to a size category then it is defined as coming within that category. The categories in May 1990 were:

	<i>Small</i>	<i>Medium</i>	<i>Large</i>
Turnover	≤£1.4m	≤£5.75m	>£5.75m
Gross Assets	≤£0.7m	≤£2.8m	>£2.8m
Employees	≤50	≤250	>250

- 12 The date given for each of the surveys mentioned in this article is the year during which it was conducted. This has been done in order to highlight the time interval between surveys rather than, as has been the practice, that between the date of publication of their results.
- 13 The terms 'current study' and 'Scottish large company study' are interchanged throughout, the latter being used, where appropriate, to differentiate between it and the Scottish 'small' company study.
- 14 There was no difference in the values used in the definitions of size between the 1981 and (original) 1985 Companies Acts. The McIntyre and Coulthurst study used 1982 data to determine company size, the current study used 1986 data. Between the two year ends, the Retail Price Index rose by 20.74 per cent (from 325.5 to 393). Applying this indexation factor to the 1985 Companies Act size bands given in note 11, in order that a truer comparison may be achieved with the earlier McIntyre and Coulthurst study, produces the following:

	<i>Small</i>	<i>Medium</i>	<i>Large</i>
Turnover	≤£1.69m	≤£6.94m	>£6.94m
Gross Assets	≤£0.85m	≤£3.38m	>£3.38m
Employees	≤50	≤250	>250

The indexed and non-indexed size groupings for the current study are therefore:

	<i>Small</i>	<i>Medium</i>	<i>Large</i>
Indexed	1.2%	17.7%	81.1%
Non-indexed	0.6%	14.8%	84.6%

All references to the comparative sizes of the companies in these two studies use the index-based definition.

- 15

	<i>Small</i>	<i>Medium</i>	<i>Large</i>
Capital Expenditure	<£ 20m	£ 20m– 50m	>£ 50m
Turnover	<£250m	£250m–750m	>£750m
Profit before Interest and Tax	<£ 25m	£ 25m– 75m	>£ 75m

- 16 The turnover levels used to determine company size used by Mills and Herbert (see note 15) are approximately 200 times greater than those of the Companies Act (see note 11). Almost all the companies in the current study which were classified as 'large' according to the Companies Act criterion were classified as 'medium' or 'small' under the Mills and Herbert turnover criterion.
- 17 A test of proportions was used for significance testing throughout. A Chi-square test was also conducted in each case, with broadly similar results.
- 18 The 'primary' method is that which the survey respondents indicated was the most important. (The current, Pike, and Mills and Herbert studies all specifically asked for this information — see note 25.)
- 19 $78/58 = 1.34 \Rightarrow$ difference in usage of 34 per cent. This approach is adopted throughout whenever percentages are compared.
- 20 For examples of how companies use multiple methods in practice, see Pike (1982, pp. 86–95).
- 21 For every 100 companies in the current survey, 18 are of the same size as those in McIntyre and Coulthurst's survey; 47 per cent of $18 = 8.46$. If nothing has changed between the two survey dates, 8.46 per cent of the current survey companies would be expected to use a single method because they are of the same size as those in the McIntyre and Coulthurst survey. That would mean that 18.34 per cent $[(23.5 \text{ per cent} - 8.46 \text{ per cent})/82]$ of the other companies in the current survey used a single method.
- 22 Table 9 gives this to be 23.5 per cent and that for McIntyre and Coulthurst as 45.2 per cent: these differences are due to rounding.
- 23 Table 9 gives this to be 68.5 per cent and that for McIntyre and Coulthurst as 53 per cent: these differences are due to rounding.
- 24 No evidence exists to support the hypothesis that the adoption of the more sophisticated techniques brings about superior performance. Nevertheless, if these methods are more sound theoretically, all other things being equal, their use should provide the opportunity to achieve a superior performance. In addition, Moore and Reichert (1989) found that managerial sophistication, as reflected by the adoption of selected analytical practices and widespread encouragement of the use of microcomputers for financial analysis, positively affects the likelihood of better than average firm performance.
- 25 The current study questions were based upon those in the Pike study. All the studies used broadly similar questions though, as can be seen below, those of Mills and Herbert and McIntyre and Coulthurst went into more detail than the others in the principal question. Interestingly, McIntyre and Coulthurst did not include any request for ranking. The principal question in each survey was:

Current study

In evaluating capital investment proposals please indicate the method(s) used and rank the importance of each using 1 for the most important, 2 for the next, etc:

- (a) Payback
- (b) Internal rate of return
- (c) Net present value
- (d) Accounting rate of return
- (e) Others (please list)

Pike

What investment appraisal criteria do you use? (Please indicate priorities by giving a 1 to the most important, 2 the the next etc.)

- (a) Payback period
- (b) Average rate of return
- (c) Discounting — internal rate of return
- (d) Discounting — net present value
- (e) Other; please specify

Mills and Herbert

What financial analysis techniques are most often used in your organisation to appraise divisional capital projects? (if more than one technique is used please indicate the importance of each by giving a 1 to the most important, 2 to the next, etc.)

- (1) Net present value
- (2) Internal rate of return
- (3) Accounting rate of return
- (4) Payback period
- (5) Qualitative/non-financial
- (6) Other, please specify

McIntyre and Coulthurst

Please indicate the evaluation formula/formulae which you usually use for evaluating the prospective returns on your projects:

<i>Few</i>	<i>Most</i>	<i>All</i>
<i>Projects</i>	<i>Projects</i>	<i>Projects</i>

Payback

DCF: IRR

DCF: NPV

Accounting rate of return

Other: please specify

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