

Intuition and Real Options-Based Investment Appraisal: A Cross-National Study of Financial Executives

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Abstract

Whilst modern enterprises have well established accounting information systems reporting on discounted cash flow based information, few organisations are known to prepare and report on real options related accounting information for strategic decisions. This study investigates the potential desirability by financial executives for a real options-based approach to investment appraisal and the provision of associated accounting information. The intent of this study is threefold. It first considers how far managerial flexibility decisions that can be assessed formally via real options analysis are evaluated qualitatively and quantitatively by financial executives in a number of developed countries. The investigation then explores the extent to which these financial executives perceive value in real options-based calculative and accounting information. Finally, the study considers whether corporate strategic orientation is linked to managers' perceptions of the value of qualitative, quantitative, and accounting real options based information. The results show that qualitative assessment remains the primary form of strategic investment appraisal. However, when managers use quantitative methods, they consistently place value on numerical analysis, and desire accounting information reflecting this. In relation to the strategic orientation of organisations and managers' attitude to real options-based information, no association was found to exist empirically.

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Introduction

The role of management accounting information across different organisations has been found to differ in relation to the nature of strategic decisions that managers are confronted with (Dent, 1990; Palmer, 1992; Wilson, 1995; Chenhall and Langfield-Smith, 1998; Bhimani and Langfield-Smith, forthcoming). Strategic investment decisions often encompass an evaluation of the flexibility of the investment being considered. Taking account of managerial flexibilities in assessing investments is, according to a number of studies, reflexive to decision makers, though this is often undertaken "informally" (Smith and McCardle, 1999; Copeland and Tufano, 2004). This may be because discounted cash flow (DCF) methods of investment appraisal do not readily enable the formal assessment of flexibilities. A growing literature also claims that the association between financial options and corporate investment decision-making is intuitive (Kester, 1984; Dixit and Pindyck, 1995; Amran and Kulatilaka, 1998; Luehrman, 1998a). A real options-based investment appraisal (ROBIA) approach enables the formal assessment of managerial flexibilities and, in practice, influences the judgment of organisational decision-makers (Trigeorgis, 1996; Dixit and Pindyck, 1994; Luehrman, 1998b).

Whilst modern enterprises have well established accounting information systems reporting on DCF-based information, few organisations are known to prepare and report on real options related accounting information. Many surveys concerning capital budgeting practices have been

documented, though few investigate the attitudes of decision-makers to the use of ROBIA. This is perhaps because not many decision-makers are aware of ROBIA techniques (Grinyer and Daing, 1993).

Managerial flexibilities in relation to strategic investments appear to be evaluated largely informally. Given the possibility of using real options based accounting information to aid strategic decisions and also relying on informal assessments which closely match a real options frame of reference intuitively, it is plausible that managers would want a mix of qualitative and ROBIA calculative information for formal strategic investment decision-making. As Busby and Pitts (1997a) in a study of flexibility in capital appraisal within large UK firms note in relation to decision-makers' comprehension of ROBIA: "... their intuitions agreed with the qualitative prescriptions of such work". At present, no empirical investigation which considers the perceptions of managers in diverse countries as to the role of qualitative, quantitative, and ROBIA information in strategic management decision making has been reported. The broad objective of the present study is to address this gap.

The study's concerns are threefold. Firstly, it considers how far managerial flexibility decisions that can be assessed formally via real options analysis are evaluated qualitatively and quantitatively by financial executives without ROBIA. Secondly, the investigation explores the extent to which these financial executives perceive value in ROBIA-based accounting information. Finally, the study considers whether corporate strategic orientation is linked to managers' perceptions as to the value of qualitative, quantitative, and accounting ROBIA information.

The paper is structured as follows: the next part discusses managerial flexibilities in assessing capital investment projects and the various propositions tested. This is followed by an outline of the method for the study prior to an assessment of its propositions and a discussion of the results. The paper's concluding comments consider

the study's implications and the potential for future research in the area.

Managerial Flexibility in Assessing Strategic Investments

In practice, decision-makers assess a variety of criteria in analysing investment projects. This is because investments are rarely sufficiently well defined in terms of comprehensiveness of possible outcomes and cross-comparability. Additionally, investment variations can usually be made whilst keeping to the primary investment objective. Flexibilities often exist to alter courses of action and decisions both during the decision-making process as well as following the initial investment decision (Dixit and Pindyck, 1995; Trigeorgis, 1996; Kim and Sanders, 2002; Van Putten and MacMillan, 2004). It is possible to identify five key managerial flexibility dimensions which decision-makers address over the course of an investment's life. Certain investments can be deferred to a later time frame if decision-makers can learn from waiting. For instance, a firm may delay an investment in order to consider the influencing impact of a new technology or the actions of a competitor. Waiting time may have value, particularly where once taken, the decision to invest is not reversible but the decision to defer the investment exists. Deferring an investment can result in economic gains being altered with the passage of time. A decision-maker may thereby seek to determine the most opportune time for making the investment, where the benefits of obtaining more information and further deferring the decision to commit to the investment may have to be balanced with changing payoffs as deferral to commit is exercised. This point signals the appropriate time to take investment action.

There are occasions where following the start of an investment project, it is possible to halt the investment and sell off assets to stave possible losses. The choice of reversing a decision may follow where benefits fall short of those anticipated at the time of making the investment. The possibility of abandoning an investment project once started is a factor which may

influence the decision-maker's initial investment decision. It may be judged worthwhile for an organisation to only temporarily abandon a project with the possibility of resuming the investment project at a later time. This will also potentially influence the decision-maker's perception of the project's worth at the outset (Kumar, 2002; Luehrman, 1998b).

Some investment projects offer the possibility of making follow-on investments once the immediate project is underway. Managers may, in such instances, evaluate the likelihood that an investment could lead to further investments as possible choice outcomes of the initial investment decision. Finally, investment decisions are typically subject to risk factors and uncertainties which present managers with options at different stages of the investment process (Kogut and Kulatilaka, 1994). Such options may be taken into consideration either qualitatively or calculatively.

The existence of options results in differing conceptions of the worth of engaging in investment projects or of withdrawing from, or temporarily abandoning, or further building upon, existing investment projects. Many scholars have argued that such options have value that can be quantified at the investment proposal stage (Amran and Kulatika, 1998; Luehrman, 1998b; Copeland and Tufano, 2004).

Established approaches to the valuation of securities options can be applied to assess real investment opportunities (Pindyck, 1991). The principal argument which stems from real options pricing theory concerns the assessment of rights to make an investment at a cost in return for partaking in a project which may yield different outcomes. These rights which relate to the various managerial flexibilities discussed above proffer value *which*, if ignored, could alter the perceived worth of projects (Dixit and Pindyck, 1995; Busby and Pitts, 1996, 1997a; Van Putten and MacMillan, 2004). It has been argued that assessments of such flexibilities are intuitive to decision-makers who may not be aware of formal models which exist to capture and quantitatively evaluate the parameters and effects of these

flexibilities. One view is that it is "important that managers at least consider the options approach, even if they are unable to put precise values on the particular options" (Lefley, 1996). In a similar light, Busby and Pitts (1997b) note that:

While it is frequently not practical to carry out a detailed quantitative analysis, the [real option] theory reflects much more closely the value of capital investments than do NPV and similar methods, and it provides support for some of the more qualitative arguments on strategic decision-making.

They note their "misgivings" (Busby and Pitts, 1997a) about DCF approaches in that such calculations do not allow decision-makers to assess the value of an investment's strategic characteristics such as the possibility of waiting prior to investing or expanding the project once the investment is undertaken or of abandoning the project earlier than anticipated. Whether a project can lead to follow-up investments which could affect the project's initial worth is likewise not typically captured by DCF analysis (Luehrman, 1998a). This is because by discounting expected cash flows at a risk-adjusted rate over a predefined life, the net present value (NPV) calculation presupposes the investor's commitment to immediately deciding on a project which, if accepted, will be viewed as operating continuously through to the end of the investment period. The use of risk-adjusted discounting at a constant rate also does not adequately deal with situations in which decisions are postponed until some of the uncertainty is resolved (Amran and Kulatilaka, 1998). Uncertainty changes associated with competitive market dynamics or fluid company-specific factors are thereby ignored. The real options perspective is said to extend the potential of DCF investment appraisal approaches by identifying both "static" NPV elements and "option premiums" reflective of perceived managerial flexibilities (Trigeorgis, 1988). A number of writers have documented case studies of the application of the options

approach whereby managerial flexibilities are formally integrated into investment appraisal situations (Kemna, 1993; Balakrishnan and Bhattacharya, 1997; Copeland and Tufano, 2004). In looking at oil and gas investments, Smith and McCardle (1999) state that managers do not ordinarily make initial investment decisions only to subsequently consider the project uncertainties to be resolved and the anticipated cash flows to be realised. Rather, oil and gas firms make a series of investment decisions as the uncertainties resolve over time. The authors of the study explain that:

... when considering the development of a new oil field, of oil prices, production rates, or reserves which exceed their expectations or if production technology improves, the firm might be able to develop more aggressively or expand to nearby fields. Similarly, if prices, rates, or reserves are below expectations, the firm might be able to scale back planned investments and limit their downside exposure.

Some scholars have cast doubts on the plausibility of using real options valuation models to assess strategic investment opportunities, given the sometimes very large range of perceptions of possible outcomes from engaging in projects within extensively fluid business environments and the often high level of mathematical complexity in applying such models (Amran and Kulatilaka, 1998). Although little empirical research has been undertaken to assess how extensive the use of the real options approach is to capital investment decision-making, the view that this approach has widespread applicability is increasingly aired. This is indicative of the value of assessing how far characteristic flexible elements of capital investment decisions are evaluated qualitatively and quantitatively by senior corporate financial executives, and to explore whether quantitative assessment and, in particular, the availability of accounting information in this respect, is deemed desirable. Additionally, it is desirable to understand the perceived value of ROBIA information

within organisations pursuing different corporate strategies.

In relation to the strategic orientation of organisations and managers' attitude to ROBIA information, we deploy the widely used typological reference frame in accounting studies developed by Miles and Snow (1978, 1994). They identified four strategic types of organisations according to the rate at which they change their products and markets: prospectors, defenders, analysers, and reactors. The fundamental difference among these types is the rate of change in the organisational domain. Prospectors are characterised by their dynamism in seeking market opportunities, their capability to develop and produce new products to meet customers' needs, their large expenditures related to research and development, and their dependence on teamwork. They are usually innovators that create change in their respective industries. In broad terms, prospectors are involved in growing markets where they actively seek new opportunities through innovation. They are flexible and decentralised in their approach and able to respond quickly to change. Strategic change is not an obstacle for such companies.

Defenders have a strategy that is the polar opposite of that of prospectors. They operate within a narrow product-market domain characterised by high production volume and low product diversity. Defenders compete aggressively on price, quality, and customer service. They engage in little or no product or market development and stress efficiency of operations. Defenders are likely to face a lower level of environmental uncertainty than prospectors (Slocum et al., 1985). Defender organisations produce products or services with the objective of obtaining market leadership. They may achieve their objectives by concentrating on a market niche through speculation or cost reductions. The market may be mature or stable. The organisation is able to cope with sudden strategic change but best operates in contexts of steady strategic change.

Analysers stand between these two categories, sharing characteristics of both prospectors and defenders. They seek to expand but also to protect what they already have. They may wait for others to innovate and delay while others prove new market opportunities. Analysers may use mass production to reduce costs, but also rely on some areas such as marketing to be more responsive and provide flexibility where required. Strategic change would need careful analysis and evaluation before it is pursued actively. Reactors by contrast do not follow a conscious strategy. They are viewed as a dysfunctional organisational type in that they respond inappropriately to competitors and to the more general environment. They rarely, if ever, take the initiative and, in a sense, may have no effective strategy – they simply react to others' strategies.

The Miles and Snow typology is chosen in this study to explore the interactions between organisational strategy orientation and perception of ROBI information within the enterprises investigated. The rationale for using the Miles and Snow typology is that the capacity of an organisation to alter its mode of functioning is a key dimension of this typology (Lynch, 2000). The premise of the Miles and Snow typology is that prospector, defender, and analyser strategies, if properly implemented, can lead to effective performance (Langfield-Smith, 1997; Chenhall, 2003, 2005). It is therefore appropriate to explore whether the information assessed by managers in strategic investments has linkages to the characterising orientation of the strategy being pursued.

In the light of the prior discussion, certain propositions can be posited. Managers in different organizations exhibit differing preferences for information form (McKinnon, 1992; Bruns and McKinnon, 1993; Warglien and Masuch, 1996). Some managers can be expected to show a preference for qualitative information in assessing organizational situations and in making strategic decisions based on such information. It may be that such managers are more prone to using qualitative

information in reaching a compromise with other organisational participants who may be pursuing other objectives. In other words, qualitative information may be used as “ammunition” by some managers in negotiating with others (Burchell et al., 1980; Earl and Hopwood, 1986). Likewise, some managers may rationalise decisions ex-post using formal but qualitative information. In such instances, the information does not necessarily enhance the quality of decision-making. Indeed, the decision may simply emerge from inspiration but later come to be rationalised through the deployment of an external display of well formulated rationale. Whilst some managers appeal to qualitative information primarily, others will show a preference for quantitative information for decision-making. It may be that such information is used computationally by decision makers seeking specific answers. These managers may also seek to learn from quantification by engaging in sensitivity analyses (Burchell et al., 1980). The formal assessment of information type will in all cases be dictated by managerial proclivities. The following is proposed:

Proposition A: *Managers have different preferences for qualitative or quantitative information deployment in making strategic decisions.*

Managers who use quantitative analysis and the evaluation of numerical information in making decisions will value quantified data to aid their strategic decision making. Moreover, they will value the availability of additional accounting information relating to such decisions. This expectation will hold irrespective of managerial appeal to qualitative information in decision making. The following is proposed:

Proposition B: *Whether or not formal qualitative information analysis is engaged in, managers who use quantified information in decision making will perceive value in calculative analysis of numerical information in strategic decision-making.*

Managers who place value on quantitative information analysis are likely to be particularly receptive to the availability of formal accounting information for strategic investment decisions. The following is proposed:

Proposition C: *Managers who value numerical and quantitative analysis relating to strategic investment decisions will also value accounting information for such decision making.*

The view that the strategic orientation of an organization should be aligned within accounting information provision has been extensively aired (Bromwich, 1990; Palmer, 1992; Shank, 2006). The empirical literature on whether organisations actually alter their accounting information system output to match corporate strategy is mixed (Chenhall, 2006). In relation to strategic investment decision issues relating to timing, multiple outcomes and managerial flexibilities would not be expected to differ across enterprises (Botteron et al., 2003). This is because, such issues can be deemed to affect strategic decisions generally irrespective of the strategic focus of a firm. The following is proposed:

Proposition D: *Managers will not value information type differentially based on their firms' strategic orientation.*

Methodology

A questionnaire was designed which identified the five characteristic flexible elements which could affect strategic investment project decision and which are amenable to formal evaluation under the real options pricing approach, as discussed in the previous section. For each information item entailing elements of flexibility, four questions were asked in the questionnaire. Firstly, the respondent is asked to state whether or not, in his or her company, the item in question is evaluated qualitatively. Secondly, the respondent is asked whether or not the item is evaluated numerically and affects the calculations performed. Thirdly, the respondent is asked whether the item should ideally be evaluated numerically and should affect the

calculations performed in the analysis of the investment. Finally, the respondent is asked whether accounting information about the item in question should be available. The scale used for the responses is: Strongly Agree/Agree/Undecided – Do not Know/Disagree/Strongly Disagree. Appendix 1 reproduces the English version of the questionnaire.

We included a second set of questions in the survey in which managers are asked to select one of three strategic orientation dimensions to describe their firms (see Appendix 2). The three descriptions directly capture the Miles and Snow types: “Analysers”, “Prospectors”, and “Defenders”. We use the responses from this part of the questionnaire to test the last proposition.

The questionnaire was translated into French, German, Italian, and Japanese by academics from these countries. The questionnaires were translated back into English by different academics. This resulted in some stylistic revisions for the non-English language questionnaires. The questionnaire was sent to financial directors of companies in seven countries: Canada, France, Germany, Italy, Japan, UK, and US. Only questionnaire returns received during the first five weeks of the survey period were included in the investigation.

The population surveyed in Canada included the 500 largest companies of the Blue book of Canadian Business. The survey in France was sent to the 500 largest companies of the database “L’expansion: Les 1000, performance et classement des plus grandes entreprises françaises”. In Germany, the survey was sent to the 500 largest companies. The list was provided by Frankfurter Allgemeine Zeitung GmbH Information Services. The Italian population consisted of the largest 450 Italian companies and the list was provided by the Italian Trade Center. In Japan the questionnaire was sent to the 500 largest companies listed by Nitikei Shinbun. In the UK, the survey was sent to the 500 largest companies¹ of the Times 1000 UK

¹ Size was measured by the amount of revenues

companies. Lastly, in the US, the population was made up of the largest 500 firms in the Moody's Industrial manual.

Four hundred and sixteen questionnaires were sent back to the researchers of which 338 were usable. Table One shows the number of usable responses from each country. The largest group of respondents relate to Germany and Japan (69 each) and the UK (63) while Italy and Canada (29 each) represent the smallest. This gap may be explained by the fact that financial executives from the UK and Germany have been receptive to the opportunity to participate in surveys over the last decade (Innes and Mitchell, 1991; Drury and Tayles, 1994; Innes et al., 2000). This not the case for those from companies in France

and Italy where only a small number of surveys have been carried out.

The response rate for a survey across such a large number of countries cannot be expected to be as high as in a standard study. The researchers could not perform follow-up procedures because of the costs involved as well as the language barriers. The absence of follow-up procedures is a common limitation in this type of cross-country study. Japan and Germany have the highest response rates of usable questionnaires at 13.8%. This is followed by UK (12.6%), US (9.0%), and France (6.8%). Canada and Italy have the lowest response rates at 5.8% and 6.4%, respectively.

Table One: Number of respondents by country

	Canada	France	Germany	Italy	Japan	UK	US	Total
Total	35	39	73	32	95	85	57	416
Respondents								
Response rate	8.4%	9.4%	17.6%	7.7%	22.8%	20.4%	13.7%	
Usable questionnaires*	29	34	69	29	69	63	45	338
Response rate	5.8%	6.8%	13.8%	6.4%	13.8%	12.6%	9.0%	9.8%

*Usable responses means no missing values to questions in Appendix 1.

Results

General Observations and Descriptive statistics

The results for the responses to Column A on qualitative assessment are summarised country by country in Table Two. The responses are binary in nature, with a "1" signifying a "Yes" and a "2" signifying a "No". In response to question 1 (see Appendix 1) concerning whether the decision to invest can be delayed is evaluated qualitatively, the overall mean response (see last column) was 1.31 (69% affirmative) with the US respondents revealing the highest affirmative score (1.07 or 93%) and the UK the lowest (1.47 or 52%). On the second question, regarding whether the reversibility of an investment is an information item which is evaluated qualitatively, the overall average was 1.38

(62% affirmative) with the French respondents having the most affirmative score (1.21 or 79%) and the UK the least (1.51 or 49%). On the third question of qualitatively assessing whether the investment can be temporarily abandoned after it is started, the overall mean score was 1.44 (56% affirmative) with French respondents being most affirmative (1.26 or 74%) and the UK the least (1.57 or 43%). On the fourth question of qualitatively evaluating whether the investment could lead to other investments, respondents rated on average 1.30 (70% affirmative) with the Canadian financial executives evidencing the most affirmative response (1.03 or 97%) and the UK the least (1.43 or 57%). On the fifth question of qualitative assessment of risk/uncertainty elements affecting when to

invest, the overall average response was 1.28 (72% affirmative) with Japan being the most affirmative (1.16 or 84%), and the UK the least (1.48 or 52%). Chi-square tests for independence across samples indicate that

the assumption that the different country samples are similar is rejected for each of the five questions.

Table Two: The Qualitative Assessment of Managerial Flexibilities (Column A)

Question	Canada (n=29)	France (n=34)	Germany (n=69)	Italy (n=29)	Japan (n=69)	UK (n=63)	US (n=45)	Total (n= 338)
1. Can the investment decision be delayed?								
Yes	24 (83%)	26 (76%)	48 (70%)	20 (69%)	41 (59%)	33 (52%)	42 (93%)	234 (69%)
No	5 (17%)	8 (24%)	21 (30%)	9 (31%)	28 (41%)	30 (47%)	3 (7%)	104 (31%)
Mean (std dev)	1.17 (0.38)	1.23 (0.43)	1.30 (0.46)	1.31 (0.47)	1.40 (0.49)	1.47 (0.50)	1.07 (0.26)	1.31 (0.46)
Chi-Square = 27.04 (p < 0.0001)								
2. Can the investment be reversed (i.e. are disinvestments possible with minor/no losses)?								
Yes	21 (72%)	27 (79%)	40 (58%)	20 (69%)	37 (54%)	31 (49%)	33 (73%)	209 (62%)
No	8 (23%)	7 (21%)	29 (42%)	9 (31%)	32 (46%)	32 (51%)	12 (27%)	129 (38%)
Mean (std dev)	1.27 (0.45)	1.21 (0.41)	1.42 (0.49)	1.31 (0.47)	1.46 (0.50)	1.51 (0.50)	1.27 (0.45)	1.38 (0.49)
Chi-Square = 15.59 (p < 0.02)								
3. Can the investment be temporarily abandoned?								
Yes	21 (72%)	25 (74%)	36 (52%)	18 (62%)	42 (61%)	27 (43%)	21 (47%)	190 (56%)
No	8 (28%)	9 (26%)	33 (48%)	11 (38%)	27 (39%)	36 (57%)	24 (53%)	148 (44%)
Mean (std dev)	1.28 (0.45)	1.26 (0.45)	1.47 (0.50)	1.38 (0.49)	1.39 (0.49)	1.57 (0.50)	1.54 (0.51)	1.44 (0.50)
Chi-Square = 14.89 (p < 0.02)								
4. Can the investment lead to other investment opportunities?								
Yes	28 (97%)	27 (79%)	43 (62%)	20 (69%)	46 (67%)	36 (57%)	38 (84%)	238 (70%)
No	1 (3.%)	7 (21%)	26 (38%)	9 (31%)	23 (33%)	27 (43%)	7 (16%)	100 (30%)
Mean (std dev)	1.03 (0.18)	1.21 (0.41)	1.38 (0.49)	1.31 (0.47)	1.33 (0.47)	1.43 (0.49)	1.16 (0.37)	1.30 (0.46)
Chi-Square = 23.01 (p < 0.0008)								
5. Do risk/uncertainty elements affect when to invest?								
Yes	23 (79%)	29 (85%)	43 (62%)	21 (72%)	58 (84%)	33 (52%)	38 (84%)	245 (72%)
No	6 (21%)	5 (15%)	26 (38%)	8 (28%)	11 (16%)	30 (47%)	7 (16%)	93 (28%)
Mean (std dev)	1.21 (0.41)	1.15 (0.36)	1.37 (0.49)	1.26 (0.45)	1.16 (1.37)	1.48 (0.50)	1.16 (0.37)	1.28 (0.45)
Chi-Square = 27.60 (p < 0.0001)								

Summary statistics of responses for individual country samples and pooled sample.

(1 = "Yes", 2 = "No"). Boldface type indicates statistical significance at p-values less than 5%.

Table Three summarises respondents' views on whether specific information items are evaluated numerically and whether they affect the calculations being performed (responses are again 1 = yes, 2 = no). On the first question, Germany and

UK are the least affirmative (46%) and US is the most affirmative (76%). On the second question, Germany is the least affirmative (41%) and Canada is the most affirmative (66%).

Table Three: The Quantitative Assessment of Managerial Flexibilities (Column B)

Question	Canada (n=29)	France (n=34)	Germany (n=69)	Italy (n=29)	Japan (n=69)	UK (n=63)	US (n=45)	Total (n= 338)
1. Can the investment decision be delayed?								
Yes	25 (86%)	25 (74%)	32 (46%)	19 (66%)	46 (66%)	29 (46%)	34 (76%)	210 (62%)
No	4 (14%)	9 (26%)	37 (54%)	10 (34%)	23 (34%)	34 (54%)	11 (24%)	128 (38%)
Mean (std dev)	1.14 (0.35)	1.26 (0.44)	1.54 (0.50)	1.34 (0.48)	1.33 (0.47)	1.53 (0.50)	1.24 (0.43)	1.38 (0.49)
Chi-Square = 27.35 (p < 0.0001)								
2. Can the investment be reversed (i.e. are disinvestments possible with minor/no losses)?								
Yes	19 (66%)	22 (65%)	28 (41%)	15 (52%)	43 (62%)	31 (49%)	27 (60%)	185 (55%)
No	10 (34%)	12 (35%)	41 (59%)	14 (48%)	26 (38%)	32 (51%)	18 (40%)	153 (45%)
Mean (std dev)	1.34 (0.48)	1.35 (0.49)	1.59 (0.49)	1.48 (0.50)	1.38 (0.49)	1.50 (0.50)	1.40 (0.49)	1.45 (0.50)
Chi-Square = 11.26 (p < 0.08)								
3. Can the investment be temporarily abandoned?								
Yes	15 (52%)	24 (71%)	25 (36%)	12 (41%)	43 (62%)	26 (41%)	18 (40%)	163 (48%)
No	14 (48%)	10 (29%)	44 (64%)	17 (59%)	26 (38%)	37 (59%)	27 (60%)	175 (52%)
Mean (std dev)	1.48 (0.50)	1.29 (0.46)	1.63 (0.48)	1.58 (0.50)	1.38 (0.49)	1.59 (0.49)	1.60 (0.49)	1.52 (0.50)
Chi-Square = 19.3432 (p < 0.004)								
4. Can the investment lead to other investment opportunities?								
Yes	19 (66%)	22 (65%)	38 (55%)	17 (59%)	37 (53%)	33 (52%)	22 (49%)	188 (56%)
No	14 (34%)	12 (35%)	31 (45%)	12 (41%)	32 (47%)	30 (48%)	23 (51%)	150 (44%)
Mean (std dev)	1.34 (0.48)	1.35 (0.49)	1.45 (0.50)	1.41 (0.50)	1.46 (0.50)	1.47 (0.50)	1.52 (0.50)	1.44 (0.50)
Chi-Square = 3.60 (p < 0.7311)								
5. Do risk/uncertainty elements affect when to invest?								
Yes	21 (72%)	26 (76%)	28 (41%)	16 (55%)	50 (72%)	35 (55%)	33 (73%)	209 (62%)
No	8 (28%)	8 (24%)	41 (59%)	13 (45%)	19 (28%)	28 (45%)	12 (27%)	129 (38%)
Mean (std dev)	1.28 (0.45)	1.24 (0.43)	1.59 (0.49)	1.45 (0.51)	1.28 (0.45)	1.44 (0.49)	1.27 (0.45)	1.38 (0.49)
Chi-Square = 25.0185 (p < 0.0003)								

Summary statistics of responses for individual country samples and pooled sample.

(1 = "Yes", 2 = "No"). Boldface type indicates statistical significance at p-values less than 5%.

On the third question, Germany is the least affirmative (36%) and France is the most affirmative (71%). On the fourth question, the US is the least affirmative (49%) and Canada is the most affirmative (66%). On the fifth question, Germany is the least affirmative (41%) and France is the most affirmative (76%). For each of the five questions, the total mean responses (the last column) are less affirmative in Table Three than in Table Two. However, on average, respondents continue to be likely to answer in the affirmative for all questions, except for Question 3 (48% affirmative). Barring questions 2 and 4, the chi-square statistic on population samples is significant for the other three questions.

The results in Table Four summarise the questionnaire's third set of questions relating to whether respondents consider that the information item should ideally be

evaluated numerically and affect the calculations performed in the investment decision analysis. The responses to this set of questions were based on a 5-point scale. Therefore, the summary statistics show the mean, median, and standard deviation. On average, for all information items there was some agreement that quantification is desirable (mean response less than 2.5). UK respondents are the least affirmative on all five questions, except Question 1, with the response on Question 3 being mean 3.03 (median 3). Germany is the least affirmative on Question 1. Canada is the most affirmative on Questions 1 and 5, France on Questions 2 and 3, and Italy on Question 4. Barring question 1, the chi-square statistic on population samples is significant for all five questions, thereby rejecting statistical similarity of different country samples.

Table Four: The Desirability for Quantification (Column C)

Question (<i>mean, median, std dev</i>)	Canada (n=29)	France (n=34)	Germany (n=69)	Italy (n=29)	Japan (n=69)	UK (n=63)	US (n=45)	Total (n=338)
1. Can the investment decision be delayed?	1.69 2.00 (0.60)	1.88 2.00 (0.98)	2.20 2.00 (1.12)	1.97 2.00 (1.05)	1.95 2.00 (0.65)	2.01 2.00 (0.75)	1.87 2.00 (0.76)	1.98 2.00 (0.87)
	Chi-Square = 7.72 (p < 0.26)							
2. Can the investment be reversed (i.e. are disinvestments possible with minor/no losses)?	2.07 2.00 (0.92)	1.82 2.00 (1.09)	2.35 2.00 (1.27)	2.00 2.00 (0.80)	2.01 2.00 (0.62)	2.57 2.00 (1.03)	2.07 2.00 (0.80)	2.18 2.00 (1.00)
	Chi-Square = 20.27 (p < 0.003)							
3. Can the investment be temporarily abandoned?	2.14 2.00 (0.92)	2.03 2.00 (1.14)	2.68 2.00 (1.29)	2.10 2.00 (1.23)	2.10 2.00 (0.60)	3.03 3.00 (0.95)	2.80 3.00 (1.18)	2.48 2.00 (1.11)
	Chi-Square = 45.15 (p < 0.0001)							
4. Can the investment lead to other investment opportunities?	1.93 2.00 (0.84)	1.94 2.00 (0.92)	2.26 2.00 (1.24)	1.90 2.00 (1.05)	2.32 2.00 (0.75)	2.57 2.00 (0.91)	2.31 2.00 (1.08)	2.25 2.00 (1.01)
	Chi-Square = 21.92 (p < 0.001)							
5. Do risk/uncertainty elements affect when to invest?	1.79 2.00 (0.68)	1.85 2.00 (1.16)	2.22 2.00 (1.03)	2.17 2.00 (1.23)	2.20 2.00 (0.74)	2.44 2.00 (0.91)	1.80 2.00 (0.76)	2.12 2.00 (0.95)
	Chi-Square = 26.90 (p < 0.0002)							

Summary statistics of responses for individual country samples and pooled sample. (1 = "Strongly Agree" to 5 = "Strongly Disagree"). Boldface type indicates statistical significance at p-values less than 5%.

Finally, the results on whether there should be accounting-based information on the individual information items are summarised in Table Five. On average there is agreement that this is desirable. The table indicates some variability in responses across the countries investigated. The least affirmative respondents are Japan (Question 1), Germany (Questions 2, 3, and 5), and the US (Question 4). The most affirmative respondents are UK (Question 1), Canada (Question 2), and France (Questions 3, 4, and 5). The chi-square

statistics are not significantly different from zero for questions 1 and 2, but are different from zero for questions 3, 4, and 5. The range of perceptions as to the potential role of accounting information in relation to the information items is reflective of the cross-country variances reported in past empirical research on management accounting information practices (Ahrens 1999; Ahrens and Chapman, 2001; Bhimani, forthcoming)

Table Five: The Desirability of Accounting Information (Column D)

Question <i>(mean, median, std dev)</i>	Canada (n=29)	France (n=34)	Germany (n=69)	Italy (n=29)	Japan (n=69)	UK (n=63)	US (n=45)	Total (n= 338)
1. Can the investment decision be delayed?	2.14 2.00 (1.03)	2.09 2.00 (1.08)	2.38 2.00 (1.24)	2.34 2.00 (1.17)	2.39 2.00 (0.84)	1.96 2.00 (0.82)	2.11 2.00 (0.91)	2.22 2.00 (1.02)
	Chi-Square = 10.30 (p < 0.11)							
2. Can the investment be reversed (i.e. are disinvestments possible with minor/no losses)?	2.03 2.00 (0.78)	2.12 2.00 (1.17)	2.59 2.00 (1.30)	2.45 2.00 (1.21)	2.38 2.00 (0.84)	2.33 2.00 (0.97)	2.31 2.00 (1.00)	2.36 2.00 (1.06)
	Chi-Square = 7.41 (p < 0.28)							
3. Can the investment be temporarily abandoned?	2.14 2.00 (0.88)	2.05 2.00 (1.20)	2.96 3.00 (1.29)	2.24 2.00 (1.06)	2.51 2.00 (0.74)	2.76 3.00 (1.00)	2.80 3.00 (1.22)	2.59 2.00 (1.10)
	Chi-Square = 27.35 (p < 0.0001)							
4. Can the investment lead to other investment opportunities?	2.14 2.00 (0.88)	2.12 2.00 (0.98)	2.45 2.00 (1.30)	2.31 2.00 (1.14)	2.58 2.00 (0.88)	2.59 2.00 (0.99)	2.64 2.00 (1.13)	2.46 2.00 (1.07)
	Chi-Square = 11.95 (p < 0.06)							
5. Do risk/uncertainty elements affect when to invest?	2.07 2.00 (0.88)	2.06 2.00 (1.15)	2.62 2.00 (1.31)	2.31 2.00 (1.28)	2.55 3.00 (0.83)	2.48 2.00 (0.98)	2.29 2.00 (0.92)	2.41 2.00 (1.07)
	Chi-Square = 13.94 (p < 0.03)							

Summary statistics of responses for individual country samples and pooled sample. (1 = "Strongly Agree" to 5 = "Strongly Disagree"). Boldface type indicates statistical significance at p-values less than 5%.

Managerial Preferences for Qualitative and Quantitative Information

Prior studies indicate that managers take into account complex considerations relating to managerial flexibility in strategic decision making but only quantify a minority of these sets of issues (Dixit and

Pindyck, 1994; Copeland and Tufano, 2004; Van Putten and MacMillan, 2004). A number of empirical studies on the form of management accounting information used by managers in relation to the mix between qualitative and quantitative information has been documented (Bruns and McKinnon,

1993). These studies suggest that qualitative evaluations tend to relate to a wider set of decision making variables than quantitative information evaluation. Moreover, qualitative assessments often precede quantification. In other words, calculative assessment approaches become established subsequent to and in addition to the qualitative assessment of factors impacting on managerial decision making. As noted above, some managers may use qualitative information as negotiating tools - “ammunition”- or as “rationalisation” techniques as opposed to more direct computational analysis or to promote

sensitivity-based learning. But this may be the case for quantitative or qualitative information. There is little understanding at present on the extent to which managers tend to qualitatively evaluate information relating to large capital investments rather than quantify such information, just as we know little about the rationales for preferences. In relation to general decision making however, managers are found to be more likely to qualitatively assess information rather than to engage in quantified assessments. This is in spite of long standing calls to apply quantitative approaches to managerial decision making.

Table Six: Comparison of Responses to Columns A and B for Pooled Sample

Question	Column A	Column B	t-stat (p-value)
1. <i>Can the investment decision be <u>delayed</u>?</i>	1 = 234 2 = 104 69% affirmative	1 = 210 2 = 128 62% affirmative	1.95 (0.05)
2. <i>Whether the investment is <u>reversible</u> (i.e. are disinvestments possible with minor/no losses)?</i>	1 = 209 2 = 129 62% affirmative	1 = 185 2 = 153 55% affirmative	1.87 (0.06)
3. <i>Can the investment be <u>temporarily</u> abandoned?</i>	1 = 190 2 = 148 56% affirmative	1 = 163 2 = 175 48% affirmative	2.08 (0.04)
4. <i>Can the investment lead to <u>other investment opportunities</u>?</i>	1 = 238 2 = 100 70% affirmative	1 = 188 2 = 149 56% affirmative	4.08 (0.00)
5. <i>Do risk/uncertainty elements affect <u>when to invest</u>?</i>	1 = 245 2 = 93 72% affirmative	1 = 209 2 = 128 62% affirmative	3.08 (0.00)

Tests of statistically different responses using Wilcoxon Signed Rank-Sum test for paired sample. (1 = “Yes”, 2 = “No”). Boldface type indicates statistical significance at p-values less than 5%.

The analysis in Table Six tests *Proposition A* and presents a comparison of the responses to Columns A and B. For each column the number of 1=Yes and 2=No responses are tabulated and the two

columns are compared using the Wilcoxon Signed Rank-Sum test. The results in Table Six show that for each type of evaluation category the level of qualitative assessment exceeds quantitative analysis. This is in

line with the results of prior studies of management accounting information usage. Aside from evaluating the reversibility of investments which show significantly more qualitative than quantitative analysis at the 10% level, for all other decision items, this is supported at least at the 5% significance level.

The results of the investigation reveal some minimal country trends. For instance, in considering the extent to which the decision to invest can be reversed or temporality abandoned, the French respondents were most affirmative. This may suggest the “grandes ecoles” leaning of very senior French managers (Barsoux and Lawrence, 1991; D’Iribarne 1989). By contrast, the UK respondents were consistently found to be the least affirmative on the qualitative assessment of decision items. This may be suggestive of the perception by financial managers in the UK as to the value of primarily quantifying information before it can be deemed to serve decision making needs effectively (Sheridan, 1995). On the issue of whether specific information items are evaluated numerically and whether they should affect the calculations being performed, German respondents, whilst positive, were in the most part the least receptive to this. This may be reflective of German financial executives having, in large part, received a prior education focussed on business economics which stresses the effective tracing of economic flows and a predilection for developing economically structured ways of interpreting organisational activities, rather than according precedence to the decision usefulness of economic quantification (Lawrence 1989, 1994; Locke, 1989; Lane, 1989, 1990).

The Managerial Utility of Numerical Analysis and Accounting Information

In this analysis we propose that regardless of whether managers engage in qualitative analysis, they will perceive value in numerical analysis when such analysis is engaged in. In other words, the perceived

benefits of quantitative analysis will generally exist where real options based investment calculations are already being performed irrespective of whether qualitative evaluation is also considered important (Amran and Kulatikala, 1998; Mun, 2002; Fichman, 2004).

This is because certain decision items will be regarded by managers as important in terms of qualitative information assessment whereas others will not. This should, however, not alter the perceived value placed on the desirability of quantification. A parallel argument can be made for the desirability of accounting-based information. That is, such desirability will not necessarily be driven by whether or not qualitative assessment is engaged in. We would expect that where numerical information on a decision item is assessed, managers will likely place value on accounting-based information in relation to the decision item. Generally, managers evaluating information quantitatively and qualitatively perceive value in the numerical analysis of investment decision information items. Of significance in the present investigation is whether they place value on accounting information relating to these items. *Proposition B* states that where managers evaluate a decision item numerically, regardless of qualitative evaluation, we expect that calculative analysis of strategic investment decision items would be regarded as useful, and these managers would place value on accounting-based information on such decision items.

It is plausible that some managers will not engage in the qualitative or quantitative analysis of information in decision making at all. If they regard quantification as undesirable, then it would be expected that such managers are unlikely to see value in accounting-based numbers. Finally, some managers will only perceive value in qualitative assessments of information items and will not regard quantification and accounting information as valuable. Our results confirm these expectations.

Table Seven: Perceive Value in the Calculative Analysis of Numerical Information In Strategic Decision-Making. (Proposition B)

A (1 or 2)	B No of responses	(i)		(ii)	
		C Mean, Median	Chi-square (p-value)	D Mean, Median	Chi-square (p-value)
Q1: Can the investment decision be <u>delayed</u>?					
Q1A = 1	Q1B = 1	1.70	43.94 <i>(0.0001)</i>	1.95	26.07 <i>(0.0001)</i>
	165	2		2	
	Q1B = 2	2.50		2.65	
	69	2		2	
Q1A = 2	Q1B = 1	1.96	0.15 <i>(0.65)</i>	2.24	0.24 <i>(0.61)</i>
	45	2		2	
	Q1B = 2	2.14		2.42	
	59	2		2	
Q2: Whether the investment is <u>reversible</u> (i.e. are disinvestments possible with minor/no losses)?					
Q2A = 1	Q2B = 1	1.82	23.74 <i>(0.0001)</i>	2.04	17.12 <i>(0.0001)</i>
	142	2		2	
	Q2B = 2	2.52		2.64	
	67	2		3	
Q2A = 2	Q2B = 1	2.05	7.54 <i>(0.006)</i>	2.21	7.08 <i>(0.007)</i>
	43	2		2	
	Q2B = 2	2.57		2.73	
	86	2		3	
Q3: Can the investment be <u>temporarily</u> abandoned?					
Q3A = 1	Q3B = 1	2.01	18.70 <i>(0.0001)</i>	2.13	9.58 <i>(0.002)</i>
	127	2		2	
	Q3B = 2	2.70		2.65	
	63	2		2	
Q3A = 2	Q3B = 1	2.08	19.30 <i>(0.0001)</i>	2.42	10.51 <i>(0.001)</i>
	36	2		2	
	Q3B = 2	3.03		3.12	
	112	3		3	
Q4: Can the investment lead to <u>other</u> investment opportunities?					
Q4A = 1	Q4B = 1	1.80	44.84 <i>(0.0001)</i>	2.05	39.55 <i>(0.0001)</i>
	148	2		2	
	Q4B = 2	2.64		2.83	
	90	2.5		3	
Q4A = 2	Q4B = 1	2.20	5.45 <i>(0.01)</i>	2.45	3.12 <i>(0.07)</i>
	40	2		2	
	Q4B = 2	2.78		2.9	
	60	3		3	
Q5: Do risk/uncertainty elements affect <u>when to invest</u>?					
Q5A = 1	Q5B = 1	1.81	33.80 <i>(0.0001)</i>	2.14	17.95 <i>(0.0001)</i>
	168	2		2	
	Q5B = 2	2.58		2.80	
	77	2		3	
Q5A = 2	Q5B = 1	2.27	0.23 <i>(0.62)</i>	2.49	0.66 <i>(0.41)</i>
	41	2		2	
	Q5B = 2	2.35		2.63	
	52	2		2	

Table Seven tests whether (i) if B = 1 (i.e. Yes), then C will always be closer to 1 (i.e. SA) irrespective whether A is 1 or 2, and (ii) if B = 1 (i.e. Yes), then D will always be closer to 1 (i.e. SA) irrespective of whether A is 1 or 2.

Table Seven tests *Proposition B* and provides support for it. Specifically, we test whether for those items where respondents answer “1” or “yes” in Column B, the responses to Columns C and D are also closer to 1, regardless of their response to Column A. We find that this is consistently the case. For example, when respondents reply “1” to Q1B, the median response to Q1C is 1.70, whereas when the response is “2” to Q1B, the median response to Q1C is 2.14. Similarly, when

the respondents reply “1” to Q1B, the median response to Q1D is 1.95, whereas when the response is “2” to Q1B, the median response to Q1D is 2.65. This indicates that the general desirability of quantification of information is carried over to Columns C and D. Chi-squared statistics show that these differences in responses to Columns C and D are statistically significant when partitioned along responses to Column B.

Table Eight: Summary Statistics from Regression of Column D Responses on Column C Responses

$$D = \omega_0 + \omega_1 C + \omega_2 \text{Country Controls} + \varepsilon$$

	ω_0 coefficient t-stat <i>(p-value)</i>	ω_1 coefficient t-stat <i>(p-value)</i>	Adjusted R-squared
1. Can the investment decision be delayed?	1.04 5.78 (0.0001)	0.64 12.04 (0.0001)	0.31
2. Can the investment be reversed (i.e. are disinvestments possible with minor/no losses)?	0.51 3.02 (0.002)	0.74 17.05 (0.0001)	0.47
3. Can the investment be temporarily abandoned?	0.51 3.31 (0.001)	0.76 20.44 (0.0001)	0.59
4. Can the investment lead to other investment opportunities?	0.71 4.28 (0.0001)	0.74 17.37 (0.0001)	0.48
5. Do risk/uncertainty elements affect when to invest?	0.74 4.27 (0.0001)	0.74 15.50 (0.0001)	0.43

These results show that if the independent variable is thinking numerical accounting should be used in calculations, then accounting information should be available. Boldface type indicates statistical significance at p-values less than 5%.

Association between Numerical and Accounting Information

Using regression analysis, Table Eight assesses *Proposition C* that the propensity to engage in numerical and quantitative analysis will be associated with the perception that supporting accounting information would be desirable.

To investigate this, the responses in Column D are regressed on the responses in Column C and the appropriate country indicator variables. For all five sets of questions the coefficient on Column C responses is positive with a highly significant t-statistic. The R-squared values are reasonably high ranging from 31% to 59%. These results indicate a strong association between the desirability of numerical information and the need for accounting information.

Strategic Decisions and Real Options Information

Finally the analysis uses the responses on strategic orientation from Appendix 2. Respondents were asked whether they consider themselves Analysers, Prospectors, or Defenders.

In testing *Proposition D* we evaluate whether responses to Columns C and D vary in relation to whether managers consider themselves Analysers, Prospectors, or Defenders. Checking (a) would correspond to being an “Analyser”, checking (b) would correspond to being a “Prospector”, and checking (c) would correspond to being a “Defender”. We expect no significant differences across the three categories as predicted in *Proposition D*.

This is because Prospectors tend to assess strategic uncertainties extensively as they take on more risk in relation to corporate investments. On the other hand, Defenders tend to be more calculative analysis oriented as has been extensively argued in the prior literature. Analysers as a mid-form strategic orientation between prospectors and defenders would by definition also not differ in respect to their

responses to Columns C and D. However, for the managerial flexibilities we assess, all firms irrespective of strategic orientation can be expected to place value on numerical and accounting information. Thus manager preferences for information form rather than strategic orientation can be expected to prevail.

Our statistical tests investigate whether responses to individual questions in Columns C and D vary depending on whether companies consider themselves Analysers, Prospectors, or Defenders. For this we apply ANOVA tests and the results from this analysis are summarized in Table Nine.

In part 1 of Table Nine, we test the Column C responses to the first question (whether the investment can be delayed) across Analysers, Prospectors, and Defenders. We also separately tests whether the Column D responses to this question vary across the three types of companies. As predicted, there are no differences in responses to the individual questions, for Columns C and D, across the three types of companies. For question 5, (whether risk/uncertainty elements affect when to invest) the responses across the three company types are significantly different for Column C and marginally different for Column D.

The above results are consistent with the prior literature which suggests that prospectors take more risks and engage extensively in the assessment of uncertainties which a real options perspective to decision making enables. But conversely, defenders will be expected to more extensively engage in formal investment evaluation of operational factors and managerial flexibilities and to make extensive use of accounting reports.

Given that real options based management flexibility information is both strategy and quantitatively focused and can be captured in accounting information based terms, our expectation that their net effect balance out is demonstrated by our findings.

Table Nine: Summary Statistics on Columns C and D depending on whether Companies are Analysers, Prospectors, or Defenders

<i>1. Can the investment decision be delayed?</i>				
	C Mean Median	Anova across Column C F-stat (p-value)	D Mean Median	Anova across Column D F-stat (p-value)
Analysers n = 131	2.01 2		2.22 2	
Prospector n = 100	1.92 2	0.36 (0.69)	2.15 2	0.54 (0.58)
Defender n = 104	2.01 2		2.30 2	
<i>2. Whether the investment is <u>reversible</u> (i.e. are disinvestments possible with minor/no losses)?</i>				
Analysers n = 131	2.22 2		2.34 2	
Prospector n = 100	2.14 2	0.22 (0.80)	2.28 2	0.61 (0.54)
Defender n = 104	2.15 2		2.44 2	
<i>3. Can the investment be temporarily abandoned?</i>				
Analysers n = 131	2.53 2		2.64 2	
Prospector n = 100	2.44 2	0.23 (0.79)	2.50 2	0.48 (0.62)
Defender n = 104	2.46 2		2.61 2	
<i>4. Can the investment lead to <u>other</u> investment opportunities?</i>				
Analysers n = 131	2.30 2		2.51 2	
Prospector n = 100	2.21 2	0.24 (0.79)	2.38 2	0.45 (0.64)
Defender n = 104	2.23 2		2.48 2	
<i>5. Do risk/uncertainty elements affect when to invest?</i>				
Analysers n = 131	2.17 2		2.35 2	
Prospector n = 100	1.94 2	3.17 (0.04)	2.30 2	2.31 (0.10)
Defender n = 104	2.25 2		2.60 2	

There is generally no difference in responses to the sets of questions for analysers, prospectors, and defenders. Boldface type indicates statistical significance at p-values less than 5%.

Conclusion

The results of the study broadly suggest that value can be accorded by financial managers for more quantitative evaluations of managerial flexibilities in corporate assessments of investment options than the responding firms currently engage in. Moreover, the managerial accounting function could play an enhanced role in the provision of managerial flexibility-based information. There is some pattern in certain countries taking a stronger stance than others on the investment flexibility assessment issues explored in the investigation. For instance, the UK respondents on average are less affirmative than the mean respondent on both the qualitative and quantitative assessment of information items. The UK respondents are also less in agreement than the average on whether there should ideally be numerical analysis of the information items. There is, however, more acceptance than average among UK respondents that accounting-based information regarding whether investment decisions can be delayed and on the reversibility of investments. The Canadian and the French respondents generally make greater use of both qualitative and quantitative information in assessing managerial flexibilities. Both groups are also highly receptive to regarding quantitative and accounting information across all categories of managerial flexibility information as potentially useful. Whilst this investigation

has not sought to make conjectures about whether there are cultural specificities or national distinctiveness in relation to the perceived use or value perceived for specific information form, some very tentative and purely speculative explanations were explored. It may be the case that the respondents in different countries reveal differential inclination to the possible use of real options based analyses and associated accounting inputs into investment decisions. More extensive investigations could lead to enhanced knowledge about the plausibility of country based differences in this respect. Collectively, our results show that qualitative assessment remains the primary form of strategic investment appraisal. However, when managers use quantitative methods, they are consistently likely to believe that the relevant items should be evaluated numerically, and that there is support for accounting information. Despite this, once managers support the deployment of numerical information, they are likely to desire accounting information. The high correlation between managers responding in the affirmative to quantitative assessment and numerical calculations holds regardless of managers' responses to the use of qualitative assessment. The same applies for quantitative assessment and accounting information

Appendix 1

For each information below, please indicate how the item is evaluated. For columns C and D use the following key:
 SA = Strongly Agree; A = Agree; U = Undecided/do not know; D = Disagree; SD = Strongly Disagree

Information Item concerning large capital outlay	A This item is evaluated qualitatively	B This item is evaluated numerically and affects the calculations performed	C This item should ideally be evaluated numerically and should affect the calculations	D <i>Accounting</i> information should be available about this item
1. Whether the decision to invest can be <i>delayed</i> .	YES/NO	YES/NO	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD
2. Whether the investment is <i>reversible</i> , ie is disinvestment possible with minor/no losses.	YES/NO	YES/NO	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD
3. Whether the investment can be <i>temporarily</i> abandoned after it is undertaken.	YES/NO	YES/NO	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD
4. Whether the investment can lead to <i>other</i> investment opportunities.	YES/NO	YES/NO	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD
5. Whether risk/uncertainty elements affect <i>when to invest</i> .	YES/NO	YES/NO	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD	<input type="checkbox"/> SA <input type="checkbox"/> A <input type="checkbox"/> U <input type="checkbox"/> D <input type="checkbox"/> SD

Appendix 2

Compared to other companies in your industry which of the following descriptions most closely matches your company (tick **one** only):

- (a) We operate in two types of product-market domains, one relatively stable, the other changing. In the stable areas, we operate routinely and efficiently through use of formalised structures and processes. In more turbulent areas, top managers watch competitors closely for new ideas, and rapidly adopt those which appear to be the most promising.

OR

- (b) We continually search for market opportunities, and regularly experiment with potential responses to emerging environmental trends. We are often the creators of change and uncertainty to which our competitors must respond. However, because of our strong concern with being “first-in” in new product and market areas, we may not maintain market strength across all areas.

OR

- (c) We have a narrow product-market domain. Top managers are highly expert in the company’s limited area of operation but do not tend to search outside their domains for new opportunities. We seldom need to make major adjustments in technology, structure, or methods of operation. Instead we devote primary attention to improving the efficiency of existing operations and doing the best job possible in a limited area.

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