

Strategic investment decision-making practices in large UK manufacturing companies: a role for emergent analysis techniques?

1. Introduction

Strategic Investment Decision-Making (SIDM) practices reflect the art and science of steering and controlling organisational resources to achieve a desired strategy. SIDM processes are substantial, complex, uncertain, non-programmed, subjective, competitively oriented with a new strategic direction and long-term impacts. To maintain alignment with organisational strategy, companies adopt and adapt pre-decision control mechanisms before and alongside SIDM processes. These pre-decision control mechanisms comprise intellectual and organisational principles and standards. This includes policies, procedures, compliance, and decision makers' judgements inherent in experience and a thorough knowledge of contextual factors of the business environment (see Alkaraan and Northcott, 2007; Harris, Emmanuel, and Komakech, 2009; Emmanuel et al., 2010; Carr et al., 2010; Alkaraan and Northcott, 2013; Alkaraan, 2016; Huikku, Karjalainen and Seppala, 2018).

SIDM practices can be hindered by inadequate pre-decision control mechanisms, insufficient evaluation of strategic investments opportunities or incapability to attain synergy. The last two decades have witnessed considerable change, particularly in multinational companies that have been forced by the globalisation of markets to regenerate their processes, structures and strategies. Companies increased mergers and acquisitions to remain competitive through innovations in products, processes and information technologies to achieve successful strategies in the business arena of the twenty-first century. Successful SIDM processes require reliable, accessible, accurate, consistent, timely and contextual information. Internal and external information (at macro-economics and micro-economics levels) including information about environmental and social issues; and financial and non-financial information. These information must be cleaned, filtered, stored, relevant (to past, present and future) information. This portfolio of information is needed to cope with the risk and uncertainty associated with strategic investments and to balance the needs of the stakeholders group involved in, or surrounded by SIDM processes. Further, the comprehensive information used in SIDM processes can be viewed as backing processes or advocacy procedures to enhancing the trust, credibility and legitimacy of SIDM practices.

This paper examines the adoption of conventional and emergent analysis techniques in SIDM practices in large manufacturing companies. It aims to update the current knowledge on SIDM practices

in large manufacturing companies. It responds to a call raised by many researchers (e.g. Innes et al., 2000) for further research into the growth of strategic analysis approaches which has not been sufficiently heeded. The research question underlying this study: Are recently developed analysis techniques (i.e. those that aim to integrate strategic and financial analyses) being employed to evaluate strategic investment projects?

Section two reviews the current understanding of SIDM processes. Section 3 outlines the method employed for this study. Section 4 reports the results and is followed by a discussion and conclusions in Section 5.

2. Literature

The theory and practice of investment appraisal techniques have been investigated substantially. Comprehensive survey-based research studies have been conducted over the past four decades in both the UK and USA (see for example, Klammer and Warker; 1984; Sangster, 1993; Lefley, 1994; Pike, 1996; Drury and Tyles, 1996; Abdel-Kader and Dugdale, 1998; Arnold and Hatzopoulos, 2000; Alkaraan and Northcott, 2006; Abdel-Kader and Luther, 2008; Ma and Tyles, 2009; Graham and Sathye, 2017). The findings of these studies indicate the extensive use of formal comparative processes and procedures in both the UK and US, such as detailed budgets, the use of a combination of capital budgeting techniques, and both pre-decision and post-decision control mechanisms. A longitudinal study (based on 100 large companies) conducted in the UK by Pike (1996) regarding capital budgeting practices. Findings reveal an increased use of DCF (net present value (NPV) and internal rate of return (IRR)) in 1992 (74% and 81% respectively), compared to 1975 (32% and 44% respectively). Pike's longitudinal study also reported that in 1992 most companies adopted a combination of four techniques; payback (PB), average accounting rate of return (ARR), NPV and IRR). Drury and Tyles (1996) reported results consistent with Pike's findings (1996). Lefley's study (1994) of large manufacturing companies in the UK revealed that the use of PB (used by 94% of the companies) is greater than DCF (used by 69% of the companies). PB is widely used by UK companies compared to DCF (Drury and Tyles; 1996; Pike 1996). DCF and PB are widely used by large UK manufacturing companies (Alkaraan and Northcott, 2006). These contradictions are due to the differences in population, sample selection, size and sector of the selected companies. Therefore, it is difficult to reach a clear and unambiguous conclusion from the findings of the above-mentioned studies of financial appraisal techniques.

Another strand of research examined investment appraisal techniques in different settings (e.g. Stark, 1990; Carr, Tomkins and Bayliss, 1991; Sangster, 1993; Carr and Tomkins, 1996; Miller and O'Leary, 1997; Alkaraan and Northcott, 2006; Dobbs, 2008; Berry, Coad, Harris, Otley, and Stringer, 2009; Chittenden and Derregia, 2015). Miller and O'Leary (1997) examined the changes of capital budgeting procedure towards a comprehensive harmonised method. Carr and Tomkins (1996) highlighted the importance of strategic non-financial considerations such as value chain analysis within

the context of strategic planning. SIDM practices comprise specific adjustments to cope with the higher risk associated with strategic investments by shortening the payback and raising the required rate of return (Stark, 1991; Alkaraan and Northcott, 2006; Dobbs, 2008; Chittenden and Derregia; 2015). Companies increase hurdle rates in the absence of some applications from the evaluation dialogue, such as real option approach (ROA) analysis Stark, 1991). Similar results reported by Dobbs (2008) regarding the use of high hurdle discount rate and low PB thresholds. Chittenden and Derregia (2015) examined the consequences of irreversibility and uncertainty on capital budgeting practices. The findings of their study confirm the views of Stark (1991) and Dobbs (2008). The usefulness of ROA applications in SIDM processes is widely acknowledged by previous research (e.g. Dixit and Pindyck, 1995; Brealey, Myers and Allen, 2008).

Northcott and Alkaraan (2007) examined five emerging strategic approaches that are considered promising for strategic investment appraisal. These are ROA, technology roadmapping, benchmarking, the balanced scorecard, and value chain analysis. The current study incorporates these five approaches because they remain at the forefront of debates in recent research. A comprehensive review of the literature of both theory and practice underlying these five strategic analysis techniques is beyond the focus of the current study (see Miller and O’Leary, 2005 ; Verbeeten, 2006; Alkaraan and Northcott, 2006; Hoque, 2014; Chittenden and Derregia, 2015; Locatelli, Invernizzi and Mancini, 2016; Cooper, Ezzamel and Qu, 2017). There have been some contradictory findings regarding the practices of these approaches and their applications to SIDM practices. For example, some previous studies highlight that few professionals apply ROA analysis (see Busby and Pitts, 1997; Alkaraan and Northcott, 2006). Conversely, another strand of studies reveals that ROA applications are employed by some companies in SIDM processes (e.g. Trigeorgis, 1999; Chittenden and Derregia, 2015). Critical problems relevant to the adoption of some strategic analysis techniques were examined by Innes, Mitchell and Sinclair (2000), who employed activity-based costing by large UK companies using a comparison of the findings of two surveys (1994 and 1999). Their study indicates that the rate of growth of the adoption of activity-based costing was not maintained and some reduction is noted in 1992, compared to significant growth reported between 1987 and 1994 (from 0 to more than 20%). Accordingly, they have raised a call for further research in the future.

Financial analysis techniques form the corner stone in the evaluating investment opportunities but these techniques make up only one set of criteria that determines the outcomes of SIDM (Northcott, 1991; Harris, 1999; Miller and O’Leary, 2005; Alkaraan and Northcott, 2007 and 2013; Harris, 2014). Based on her literature review of capital budgeting and investment appraisal over more than 150 studies (1950–2004), Haka (2007) identifies the need for a comprehensive, holistic approach to examine how product markets and legal, political, regulatory, and other compliance policies interact with companies’ internal control systems. Thus, the theory and practice of SIDM have been investigated by many

researchers using different angles: social, organisational, cognitive, cultural, political, socio-economic and socio-political.

Decision makers' cognitive frames have a significant impact on SIDM. It has been argued that a better understanding of the organisational context and strategic problems may involve a decrease in the search for and analysis of information (Schwenk, 1988). Harris (2014) reached a similar conclusion: that the consequences of some decisions can be predicted with a degree of certainty, especially in cases where there is experience of making similar decisions. Intuition can be viewed as a cognitive judgement based on the previous knowledge and experience of the decision maker that is shaped by informal and unstructured approaches (Kahenman and Klien, 2009). Alkaraan and Northcott (2013) have shown that strategic investment decision makers are much more than mere technocrats anchored in financial calculation to inform their SIDM practices; on the contrary, they are experienced managers who also rely on their judgement and intuition based on a thorough knowledge of the industry.

Companies adapt their pre-decision control mechanisms to align SIDM practices with strategy (Slagmulder,1997). Alkaraan and Northcott's (2006) first survey used the description of SIDM and made a distinction between routine/operational investment decisions and those of strategic focus – strategic investment decisions characterised by high levels of complexity, ambiguity and uncertainty and high risk which have significant influence on and influenced by companies' strategies. In a further study, Alkaraan and Northcott (2007) examined the influence of pre-decision control mechanisms – such as organisational strategies, operations goals, fit with company strategy, and financial considerations including formal approval – on SIDM practices. Carr et al. (2010) examined the differences in SIDM practices based on 14 case studies of UK, US and Japanese companies. Findings reveal significant differences due to the focus on strategic against financial considerations. Based on an archival case study, Alkaraan (2016) examined the SIDM process, and addressed the importance of its initial stage: scanning and screening investment opportunities. His study focuses on three important aspects of SIDM processes neglected by previous research: the strategic problem resulting from previous SIDM undertaken by the company, the strategic choice regarding the overcoming the strategic problem, and the chronological relations between various stages of SIDM processes, from the earliest stage (scanning and screening investment opportunities) to the final stage (approval of the investment proposal). Findings indicate that for some companies, complex uncertain non-programmed SIDM practices may become semi-programmed based on knowledge gained from past SIDM. Employing a heuristic principle of analogy and metaphor, some strategic assumptions are transferred from one strategic investment project to another, using decision makers' experience gained from their past SIDM practices. Elmassri, Harris, and Carter (2016) examined SIDM processes in Egypt within its social, political and economic context. Harris, Northcott, Elmassri, and Huikku (2016) study SIDM using structuration theory based on the analysis of four cases of SIDM selected from 18 papers over the period 1970–2016. The findings of their study highlight the role of agents' knowledgeability and

position-practice relations in SIDM, aspects ignored by prior studies. Huikku, Karjalainen and Seppala (2018) examined the dynamism of pre-decision controls in SIDM practices in large Finnish manufacturing companies. Findings indicate how pre-decision control mechanisms are influenced by the changes of internal and external contextual factors, and how changes in management style may play a significant role in the adaptation process. Findings of their study, however, remain within the context of Finnish companies. Graham and Sathye (2017) examined the influence of national culture on the selection of capital budgeting systems and highlight the influence of political, legal and social uncertainty, complexity, and project size on the selection processes of capital budgeting systems.

High risk, ambiguity and complexity are key characteristics of the twenty-first century business environment. Investors, decision makers, and policy regulators face a challenge regarding the future that implicitly involves political, technological, and financial risk and uncertainty. This raises a call for both academics and professionals to pay greater attention to managing business risk through SIDM processes (Bui and De Villiers, 2017). Effective strategic control mechanisms include carbon management methods to both improve operational performance and achieve the required compliance. Effective carbon management control mechanisms are not only required for compliance with legislation, but may be crucial for maintaining companies' legitimacy, values and reputation (Bui and De Villiers, 2017).

3. Research methodology

The research evidence underpinning this study was made up of primary and secondary data, quantitative and qualitative. First, a survey consisting of a mailed formal standard questionnaire¹ was conducted where each respondent is required to answer the same questions based on the same system of coded responses. Secondly, qualitative data was collected using the annual reports of selected companies. Disclosures were used a supplementary source of information using the explanatory notes and parenthetical disclosures accompanying companies' financial reporting. Sources for these disclosures included management discussions, analyses of company strategy and risk, and forward-looking reports regarding future performance and growth opportunities (such as mergers and acquisitions activities). Accordingly, companies' disclosures were used in this study as an alternative method to semi-structured interviews to collect qualitative data. More recently, companies such as Rio Tinto have prepared strategic annual reports for 2017 against the UK Corporate Governance Code (version 2016).

Questions included in the survey are duplicated from our 2003 survey (see Alkaraan and Northcott, 2006) to facilitate comparisons with our earlier findings, and to assess the changes that may have

¹ A copy of the questionnaire is available from the authors upon request.

occurred in SIDM practices between 2003 and 2017². The sample comprised 232 large companies (minimum turnover 100 million for the year ended 2016)³, active companies, having a registered office address in in England, Scotland or Wales, Northern of Ireland or Republic of Ireland. The sample selected from different manufacturing groups from the Financial Analysis Made Easy (FAME) database using, Standards Industrial Classification (SIC), UK-code- 2007 (industry codes of two digits) as shown in Figure 1.

UK SIC (2007) – codes -	Manufacturing sub sector	Number of companies selected
10,12	Manufacture of food products; beverage; beer; bottled waters.	57
28,30	Manufacture of motor vehicles, motorcycles, engines and pumps, taps and valves.	44
13, 18,22,25	Manufacture of wood; textile; paper products; printing.	52
31,32	Manufacture of medical and dental instruments and supplies.	22
19,21	Manufacture of chemicals and basic pharmaceutical products.	19
26, 62	Manufacture of computer; electronic products; optical products and other related activities.	18
,9, 35,47, 51, 53	Mining, crude petroleum, gas, metal and other related activities.	20
		232

Figure (1): Questionnaire survey and sample frame

By the end of August 2017, 232 questionnaires had been sent out to the finance directors, taking into consideration their involvement in various stages of SIDM practices.

The participants of this study fit with upper echelon theory. Financial directors' responsibilities include raising and using available funds in effective ways to achieve targeted financial objectives. These executives are among the top executives in large companies, involved in implementing companies' goals, strategies, planning, leadership, and controlling activities, and are responsible for the performance of the company as a whole. The participation of these top executives in this study provide the required information and helps the research to be reliable based on external criteria. A covering letter addressed to the finance director outlines the study's objectives and assures participants about the study's safeguarding of confidentiality. A follow-up reminder was sent out to non-respondents using both email and mailed letters by 30 October 2017⁴. By 8 January 2018, 71 out of the 232 questionnaires were received. The size of the sample was dropped from 232 to 199 because 33 questionnaires were returned unanswered⁵. Consequently, 38 usable questionnaires were included in the analysis giving a net response rate of 19.09% (38 completed questionnaires out of 194). This response rate is acceptable

² An additional question was added to the end of the questionnaire to assess environmental management control practices.

³ Average turnover 1,498 million, and average number of employees 5,868 employees.

⁴ An e-version of the questionnaire was linked using Qualtrics (<https://www.qualtrics.com/uk/>).

⁵ 21 were questionnaires undelivered and returned from the post office. Seven of these questionnaires were returned because the named finance directors had left the companies or retired. The remaining five were returned due to the companies' policies that did not allow the directors to respond to surveys.

compared with more recent UK-based surveys (e.g. 19.60% was achieved by Abdel-Kader and Luther, 2008). 75% of respondents are finance directors, 20% are financial controllers, and the remaining 5% are chief executive officers or chief operational officers. 89% of the respondents have an accounting and finance background, while the others (11%) have backgrounds in engineering, science, operations or mathematics.

Figure (2) shows details regarding the turnover ranges and industrial classification of the responding companies. The probability of non-response bias was analysed by comparing the responding companies to the sample using turnover and number of employees. The results of the parametric *t*-test indicate statistically significant differences (*P*-value = 0.267 and *P*-value = 0.122 respectively) between the sample and the responding companies⁶.

Turnover range	% Responding companies
< £500 million.	58 %
£500 - 999 million.	13 %
> £ 1 billion	29 %
Industrial classification	
Mining, crude petroleum, gas, metal and other related activities.	21%
Manufacture of wood; textile; paper products; printing.	24 %
Manufacture of food products; beverage; beer; bottled waters.	18 %
Manufacture of chemicals and basic pharmaceutical products.	13 %
Manufacture of computer; electronic products; optical products and other related activities.	10 %
Manufacture of medical and dental instruments and supplies.	8%
Manufacture of motor vehicles, motorcycles, engines and pumps, taps and valves.	6 %

Figure (2): Details of sample frame, turnover ranges and industrial classification of the responding companies.

4. Findings of this study

4.1. Types of strategic investment projects

Decision-makers (respondents) in large UK manufacturing companies were requested to identify different types of strategic investment projects that had been implemented by their companies in the last five years (see Figure 3). A definition of strategic investment was included in the questionnaire. Figure (3) shows that two types of strategic investment decisions (acquisitions and integrated operations strategic investments) are equally ranked first (by 55% of participants) as the most widely used SIDM practices employed by the large UK companies in the last five years.

⁶ Details of non-bias tests including those respondents who replied without a reminder or any other form of follow-up (21 respondents) and respondents who replied after the follow-up procedure (17 respondents) are available from the authors upon request.

The chairman of a company that manufactures a diverse range of building materials (FTSE 100, revenue, \$40.03 billion USD, 2017) reported:

“2017 has also been another significant year of development [.....], with a total of 34 acquisition and investment transactions. In line with the Group’s strategy of continually pursuing value creation opportunities through the efficient allocation and reallocation of capital”.

(Annual report, 2017)

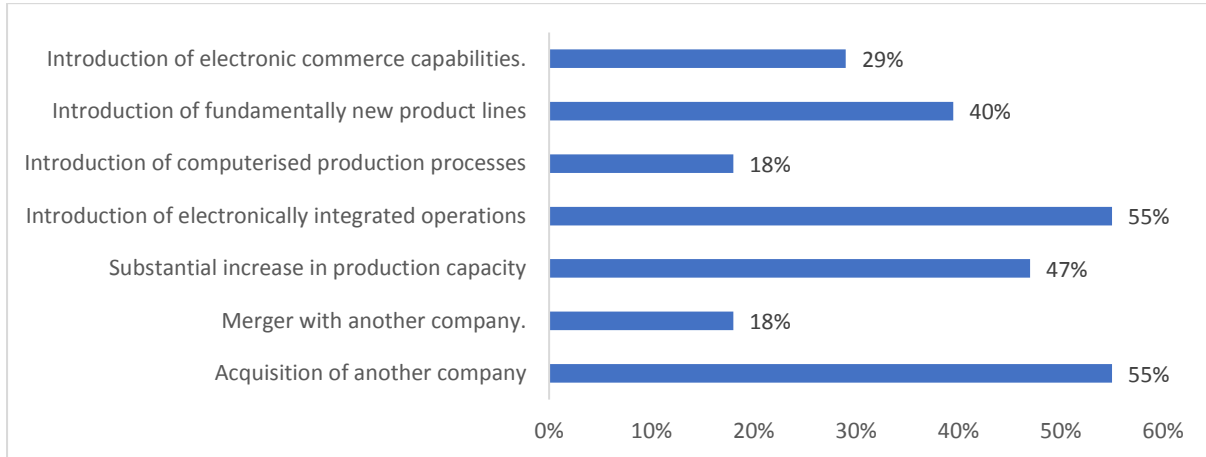


Figure (3): Types of strategic investment projects

As reported by A British Multinational Pharmaceutical company (FTSE 100, revenue: \$22.46 billion USD, 2017):

“The overall investment in the project will be higher than initially planned and now stands at more than £500 million (\$700 million), reflecting increased investment in new technologies and equipment (for example genomics, screening lab) as part of our ongoing investment in R&D in the UK. In addition, we spent \$404 million on acquiring product rights (such as in-licensing). We also invested \$201 million on the implementation of our R&D restructuring strategy”

(Annual report, 2017)

Similarly, a supplier of precision instrumentation and controls company (listed on the London Stock Exchange, FTSE 250 Index, revenue £1.526 billion GBP, 2017) stated:

“We acquire businesses which materially strengthen our operating companies through broadening their customer offering, reaching new customer segments or expanding their geographical presence. We do so when we judge that the returns generated through acquisition are better than those achievable through organic expansion [...] we seek to expand our business globally, with particular emphasis on emerging markets such as China, India and Latin America”.

(Annual report, 2017)

Macroeconomic issues remain crucial factors in scanning and screening investment opportunities, as reported by a large company that manufactures a diverse range of building materials.

“The Group’s strategy is developed, and capital investment decisions are made, based on an assessment of cash flows over a multi-decade horizon. The planning process requires modelling under macroeconomic scenarios and assumptions of both internal and external parameters. Key assumptions include: projections of economic growth; commodity prices and exchange rates, introduction of technological and productivity advancements; cost and supply parameters for major inputs”

“As we look at the broader economy, global growth momentum is healthy. US growth is supported by record high consumer confidence and healthy manufacturing investment. The EU

is also performing well on stronger manufacturing and improved consumer confidence. China may slow modestly over the next six months, but the outlook is positive in the medium to long term”

(Annual report, 2017)

4.2. Financial analysis techniques

The survey results reveal that a combination of financial analysis techniques is implemented by most companies in evaluating strategic and non-strategic investment opportunities as shown in Figure (4).

The company that manufactures a diverse range of building materials stated:

“We are committed to a disciplined and rigorous investment process – investing capital only in projects that, after prudent assessment, offer attractive returns that are well above our cost of capital”.

(Annual report, 2017)

Prior research findings (e.g. Pike, 1996; Abdel-Kader and Dugdale, 1998) indicate that managers are loyal to IRR over NPV. In contrast, the current study reveals that the NPV technique has enjoyed greater loyalty from the managers of large UK companies compared to IRR, confirming the findings of our 2003 survey.

Financial analysis techniques	Non- strategic projects		Strategic projects		Differences in means	<i>P-value Survey (2003)</i>	<i>P-value Survey (2017)</i>	
	Mean Score	Std. Deviation	Mean Score	Std. Deviation				
Sophisticated techniques	2.973	1.138	3.276	1.137	0.303	-	0.017	
	NPV	3.210	1.211	3.421	1.307	0.211	0.139	0.088
	IRR	2.736	1.266	3.131	1.166	0.395	0.257	0.017
Less sophisticated techniques	2.828	0.700	3.092	0.715	0.264	-	0.020	
	PB	3.736	1.083	4.000	0.958	0.264	0.065	0.031
	ARR	1.921	0.881	2.184	1.135	0.263	0.179	0.039

Response scale for technique use: 1 = never; 2 = rarely; 3 = often; 4 = mostly; 5 = always

Figure (4): The use of financial analysis techniques (non- strategic projects vs. strategic projects)

The results of this survey reveal that the growth rate of using a combination of investment appraisal techniques is expanding over the period (1975–2017). The results further confirm the use of a combination of investment appraisal techniques for both strategic projects and non –strategic projects (97% and 92% of respondents respectively). Despite its theoretical humbleness and limitations, the PB method still maintains its top rank as the most widely used investment appraisal technique, whether used primarily or secondarily in SIDM practices. The PB technique’s emphasis on liquidity helps companies to overcome short-term cash flow problems, as is demonstrated by several group finance directors in large UK companies (see Alkaraan and Northcott, 2006).

Notably, over the last four decades, ARR has remained a much less utilised method compared to more sophisticated techniques (NPV and IRR) that have seen significant increase in use, as shown in Figure (4). The findings of our 2006 study indicate that large UK companies employed independent strategies regarding the selection of investment appraisal techniques. The strategy is independent of the

types of investment opportunities being evaluated (strategic or non-strategic investments). To further examine this result, the tests of mean cores regarding the selection of each investment appraisal technique allowed for the use of paired sample *t*-tests to investigate the adoption of each technique with regard to strategic projects and non –strategic projects. In contrast to the 2006 study, the results of this survey indicate that there is a statistically significant difference in the mean use score between both strategic projects and non –strategic projects, as illustrated in Figure (4). This indicates that decision makers in large UK companies adopt different strategy regarding the choice and the use of investment appraisal techniques. This depends on the type of the investment opportunities being evaluated (strategic or non-strategic). Furthermore, Figure (5) illustrates the overall growth rate of the adoption of financial analysis techniques by UK companies over the period 1975–2017.

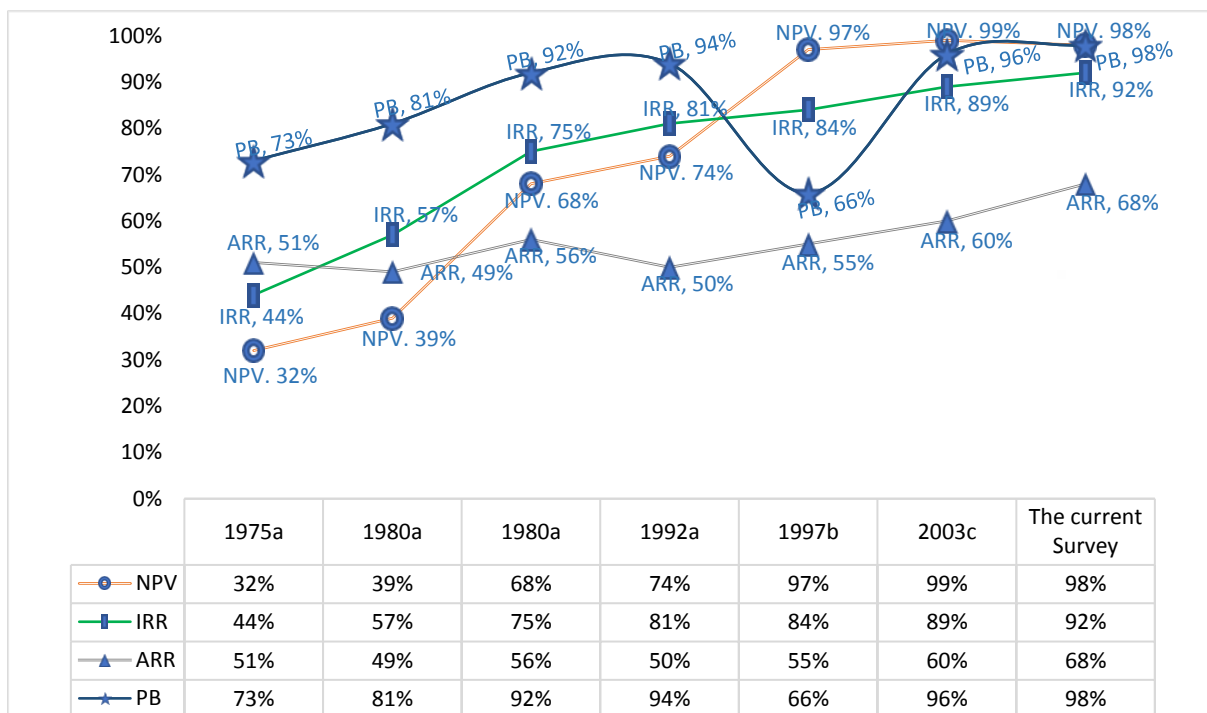


Figure (5): Development of growth rates of the adoption of a combination of financial analysis techniques in large UK companies (1975-2017). Source: ^aPike (1996), ^bArnold and Hatzopoulos (2000) ^cAlkaraan and Northcott (2006).

4.3. Risk analysis techniques

Coping with the ambiguity and uncertainty associated with strategic investment projects is one of the key practical problems faced by decision makers. Several types of risk are associated with SIDM practices, including financial, operational and strategic risks. For example, a company that manufactures a diverse range of building materials stated;

“Strategic risks, including those related to acquisitions, divestments and capital project delivery. Operational risks, including failure to manage portfolio energy requirements. [...] Financial risks, including the impact of external events and internal discipline on Group liquidity. Strategic risks, including the Group’s ability to develop new projects successfully. Operational risks, particularly in respect of sustaining capital expenditure”.

(Annual report, 2017)

It is almost impossible to eliminate these two factors from SIDM processes particularly within the context of the current global business environment. SIDM practices rooted on comprehensive knowledge and experience of the industry and markets to draw subjective judgements about the riskiness of prospective projects, but these are rarely formalized into their SIDM processes.

Figures (6) outlines the findings concerning the use of risk analysis techniques in both strategic projects and non –strategic projects. The positions based on the mean score of the adoption rates of risk analysis techniques, provide evidence that rankings were approximately similar for both types of investment project. Finance managers in large UK companies maintain loyalty to sensitivity analysis, which emerged in this study as the most widely used technique in both strategic projects and non –strategic projects. Last in ranking were computer simulation and beta analysis (CAPM), which proved to be the two least used techniques across the board (see Figure, 6). Figure (6) clearly shows that the mean scores of the use of some risk analysis techniques are significantly higher in SIDM practices compared to non-SIDM practices. These techniques are: adjusted required payback period (P -value = 0.049)⁷; adjusted required return on investment (P -value = 0.033); adjusted forecast cash flows (P -value = 0.006); probability analysis (P -value = 0.028); and sensitivity /scenario analysis (P -value = 0.007).

Risk analysis techniques						
	Non- strategic projects		Strategic projects		Differences in means	P -value
	Mean Score	Std. Deviation	Mean Score	Std. Deviation		
Adjusted required payback	2.305	1.141	2.722	1.233	0.417	0.049
Adjusted required rate of return	2.333	1.242	2.750	1.317	0.417	0.033
Adjusted discount rate	2.583	1.857	2.805	1.283	0.222	0.366
Adjusted forecast cash flows	2.388	1.293	2.888	1.304	0.500	0.006
Probability analysis	1.888	1.007	2.277	1.111	0.389	0.028
Computer simulation.	1.527	0.696	1.694	0.920	0.167	0.183
Beta analysis (CAPM)	1.611	0.766	1.777	1.017	0.166	0.324
Sensitivity /scenario analysis	2.527	1.230	3.000	1.121	0.473	0.007

Response scale for technique use: 1 = never; 2 = rarely; 3 = often; 4 = mostly; 5 = always

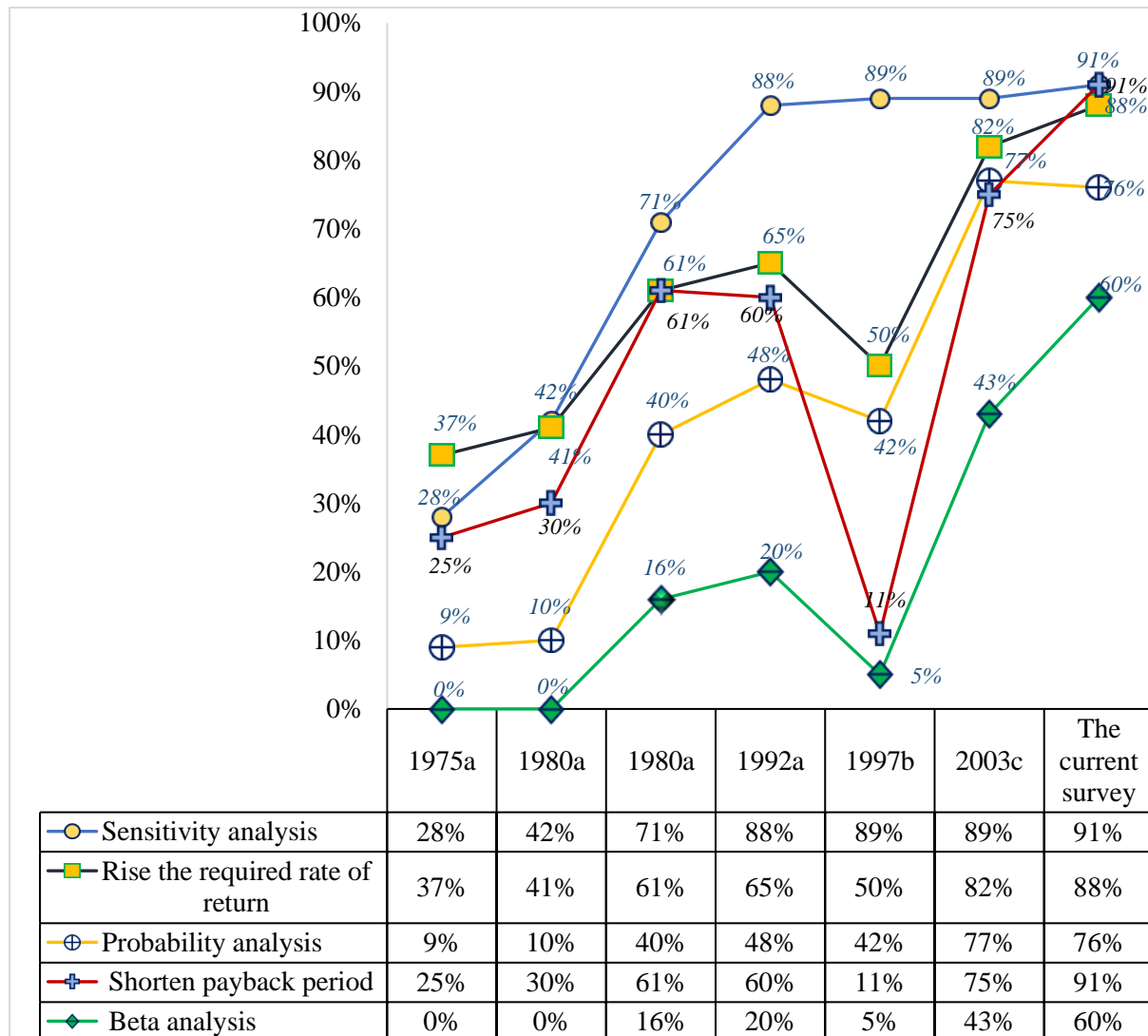
Figure (6): The use of risk analysis techniques (non-SIDM vs. SIDM)

Furthermore, the results presented in Figure (6) show that that decision makers adopt different strategies regarding the choice and the use of risk analysis techniques. This result contradicts with Alkaraan and Northcott (2006). Figure (6) shows that decision makers adopt a more sophisticated portfolio of risk analysis techniques in evaluating strategic investment projects.

Figure (7) illustrates the development of growth rates of the adoption of risk analysis techniques for investment appraisals in large UK companies over the period 1975–2017. As shown in Figure (7), UK companies maintain loyalty to sensitivity /scenario analysis as the most widely used risk analysis

⁷ 64 % of respondents required a PB period of less than 4 years.

technique over approximately four decades (since 1980). The findings of this study reveal that the most widely used risk analysis techniques are sensitivity /scenario analysis and a shortened PB period.



^a Pike (1996), ^b Arnold and Hatzopoulos (2000), ^c Alkaraan and Northcott (2006)

Figure (7): Development of growth rates of the adoption of risk analysis techniques for investment appraisals in large UK companies (1975–2017)

4.4. Strategic investment analysis approaches

SIDM practices involve the strategic analysis of investment opportunities and calls for a considered balance of strategic factors (both financial and non-financial). However, the final decision must be left to the judgement of investment committees. Respondents were required to use the Likert 5-point scale to determine the importance of ten strategic non-financial investment criteria in their decision making regarding strategic and non-strategic projects (Figure 8).

	% of responding to the importance of non-financial criteria					Mean score Out of 5
	(1) Not important	(2) Below average importance	(3) Average importance	(4) Important	(5) Very important	
The fit with corporate strategy.	0%	0%	8.3%	30.6%	61.1%	4.5278
Improved company image.	16.7%	13.9%	33.3%	33.3%	2.8%	2.9167
Requirements of customers.	0%	2.8%	5.6%	61.1%	30.6%	4.1944
Keeping up with competition	0%	5.6%	13.9%	58.3%	22.2%	3.9722
Obtaining greater manufacturing flexibility	8.6%	2.9%	28.6%	34.3%	25.7%	3.6571
The ability to expand in the future	2.8%	5.6%	13.9%	50%	27.8%	3.9444
Quality and reliability of outputs	0%	5.6%	22.2%	44.4%	27.8%	3.9444
Reduced lead-times	8.6%	8.6%	51.4%	14.3%	17.1%	3.2286
Reduced inventory levels.	8.3%	22.2%	50.0%	16.7%	2.8%	2.8333
Experience with new technology.	2.8%	22.2%	36.1%	30.6%	8.3%	3.1944

Figure (8): The importance of non-financial criteria in SIDM practices

The company that manufactures a diverse range of building materials stated:

“What we learn from our markets and customers helps us to refine our investment decisions. We deliver a number of products ourselves, with logistics capabilities that include our own networks of rail, ports and ships [...] safety and health continue to be the product group’s number one priority
(Annual report, 2017)

Figure (9) shows the development of the importance of these criteria between the 2003 survey and the current study. The results indicate that non-financial criteria are significant in SIDM practices. The company that manufactures a diverse range of building materials stated:

“Our goal is to deliver superior value for our shareholders through the cycle, and we believe the best way to do this is to focus on the “four Ps”: portfolio, performance, people and partners. We couple this with our disciplined approach to capital allocation.”
(Annual Report, 2017)

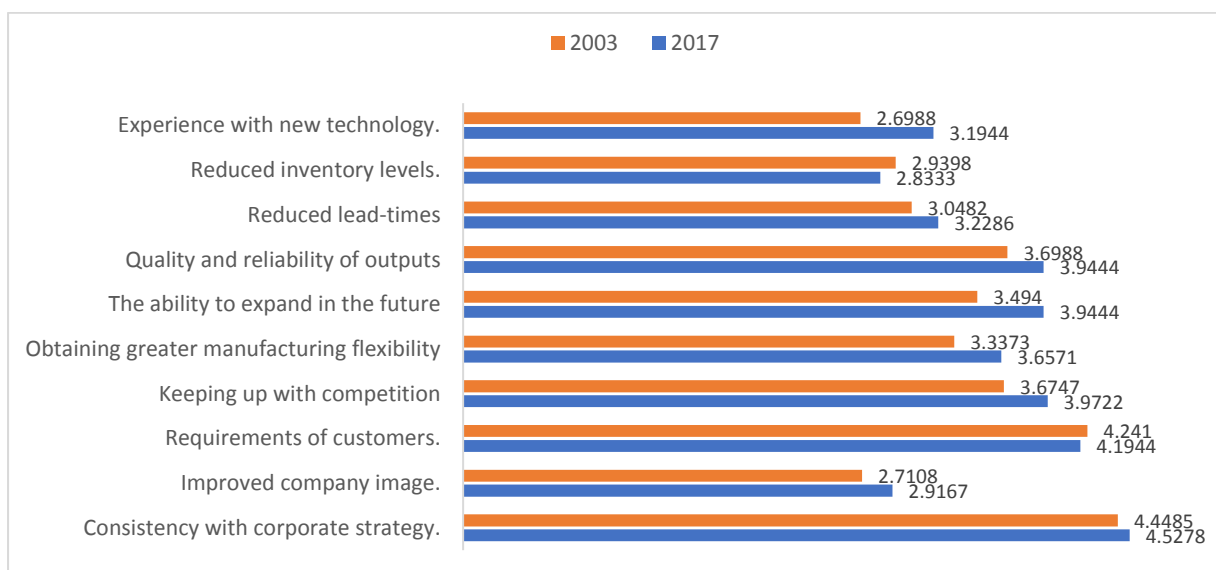


Figure (9): The importance of strategic criteria (non-financial factors) in SIDM practices (2003 compared to 2017).

Another example of a non-financial criterion is a commitment to innovation in a supplier of precision instrumentation and controls company:

“We focus on continuous innovation in new products and solutions serves to protect our market positions [...]. We build long-term relationships with our customers and work closely with them to develop an in-depth knowledge of their business”.

“We invest around 7% of sales each year in R&D in order to maintain our market-leading positions. Bolt-on acquisitions provide an alternative route to new technology”.

(Annual Report, 2017)

The survey respondents were also required to rank their use of five strategic analysis approaches identified in the literature section. Figure (10) shows the expected importance, expressed in percentages, of each of these approaches. A comparison regarding the ranking of these approaches between 2013 and 2017 is illustrated in Figure (11).

Strategic investment analysis approaches	% of respondents selecting each category of importance					Mean Score Out of 5 Survey (2003)	Mean Score Out of 5 Survey (2017)
	(1) Not important	(2) Below average importance	(3) Average importance	(4) Important	(5) Very important		
Co-ordination with investment decision of other companies (e.g. technology roadmaps)	34.3%	34. %	11.4%	17.1%	2.9%	1.77	2.20
Real options approach.	40 %	30 %	16.7%	10%	3.3%	1.67	2.06
Balanced scorecard.	32.3%	29%	16.1%	19.4%	3.2%	2.49	2.32
Benchmarking.	20.6%	17.6 %	32.4%	23.5%	5.92%	3.32	2.76
Value chain analysis.	30%	23.3%	23.2%	13.3%	10%	2.55	2.50

Figure (10): The perceived importance of various strategic investment analysis approaches.

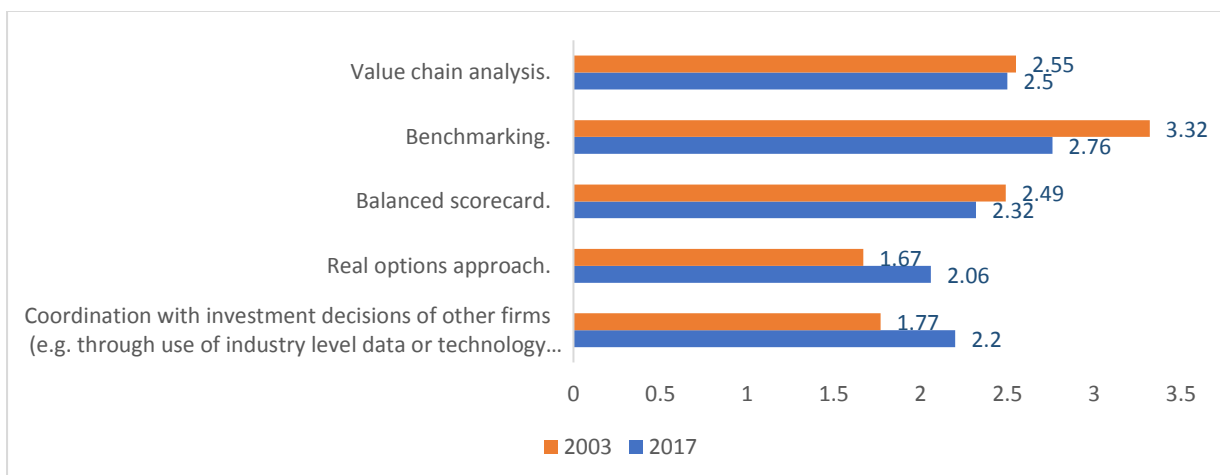


Figure (11): The perceived importance of strategic investment analysis approaches (2003 compared to 2017).

The above results requires further research in the future to ascertain whether the decision makers of large UK companies remain loyal to the adoption of these strategic investment analysis approaches in SIDM practices.

Figure (12) shows companies' SIDM practices over the last five years towards a successful environmental/carbon control strategy.

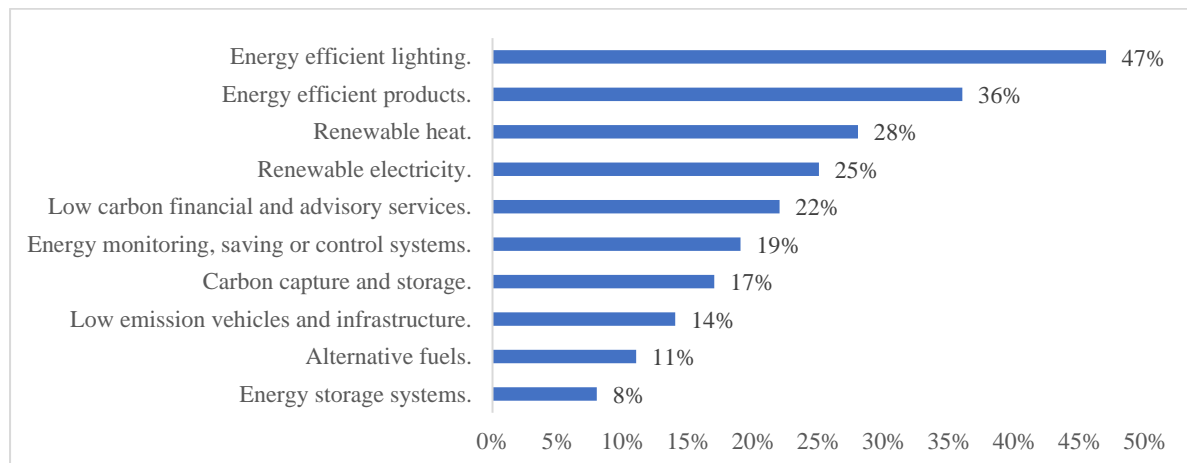


Figure (12) SIDM practices related to environmental/carbon control strategy.

As reported by a company that manufactures a diverse range of building materials

“We are committed to reducing the energy intensity of our operations and the carbon intensity of our energy. There was a 2 % reduction in greenhouse gas emissions intensity in 2017 versus 2016. We are on track to meet our target of 24 % reduction in total greenhouse gas emissions intensity between 2008 and 2020”.

(Annual report, 2017)

Energy efficiency and carbon reduction are twin imperatives of the above company's environmental management

“We take a risk-based, collaborative, strategic approach to responding to global trends in the areas of demographic change, urbanisation, climate change, resource scarcity and technological developments. [...] There was a continued reduction to 0.59 tonnes net CO₂ per tonne of cementitious product and 2017 emissions were 22% below the baseline year. The company CO₂ commitment resulted in the prevention of absolute emissions of 1.8 million tonnes of CO₂ in 2017 alone.”

(Annual report, 2017)

Another example from a leading paper-based packaging company (FTSE 100, revenue; €8.946 billion EUR 2018) regarding commitment to investing in cleaner production methods

“We have reduced fossil CO₂ emissions per produced tonne of paper by 22.9% since 2005 [...] We have reduced 31.9% of the chemical oxygen demand in the water discharge per produced tonne of paper since 2005”.

(Sustainable Development Report 2016)

5. Conclusion

Findings of this study reveal the influence of pre-decision control mechanisms on SIDM practices. This include the changes of internal and external contextual factors including organisational culture, organisational strategies, financial consideration including formal approval governance mechanisms, regulatory, and other compliance policies interact with companies' internal control systems. Companies incorporate non-financial factors alongside quantitative analysis of strategic investments opportunities. Energy efficiency and carbon reduction are key imperatives of companies' environmental management. Figure (12) shows companies' SIDM practices over the last five years towards a successful environmental/carbon control strategy. These factors viewed by decision makers as significant factors relevant for compliance with legislation as well as maintaining companies' legitimacy issues, sustainable business, experience with new technology and improved company image (Figure 8 and Figure 9). These organisational pre-decision control mechanisms influence managerial behaviour at various stages of SIDM practices. Since effective SIDM process is vital for the long-term strategic direction of an organisation, it cannot be seen as an independent activity but is an integral part of an organisation's strategy. An appropriate management control system is a key means of providing adequate strategic guidance to SIDM practices.

Decision makers face a challenge regarding the future that implicitly involves political, macroeconomics variables, technological, and financial risk and uncertainty. Findings of this study retrieve the call raised by Bui and De Villiers (2017) for both academics and professionals to pay greater attention to managing business risk through SIDM processes. High risk, ambiguity and complexity are key characteristics embedded in SIDM processes. Macroeconomic issues remain crucial factors in scanning and screening investment opportunities, as reported by this study. The early stage of SIDM processes requires modelling under macroeconomic scenarios and assumptions of both internal and external parameters. Key assumptions include: projections of economic growth; commodity prices and exchange rates, introduction of technological and productivity advancements; cost and supply parameters for major inputs. SIDM practices rooted on comprehensive knowledge and experience of the industry and markets to draw subjective judgements about the riskiness of prospective projects, but these are rarely formalized into their SIDM processes. Uncertainty, in particular, is perceived as an unavoidable element of SIDM practices. Uncertainty concerns the difficulty of determining the validity of inputs, i.e. gathering data and information on strategic investment opportunities. In some cases, it is just not possible to get complete information about the investment opportunity being considered. Also, decision-makers suffer from cognitive limitations that prevent them from following a completely rational-analytic approach. Accordingly, they satisfice rather than optimise in their information search behaviour and may not be sure of the reliability of the information that underpins SIDM practices. Coping with the ambiguity and uncertainty associated with strategic investment projects is one of the key practical problems faced by decision makers. Several types of risk are associated with SIDM practices, including financial, operational and strategic risks. Strategic risks include those related to acquisitions, divestments and company's ability to develop new projects successfully. Operational risks include failure to manage portfolio energy requirements. Financial risks include the impact of external events on cash flows management. It is almost impossible to eliminate these types of risks from SIDM processes particularly within the context of the current global business environment.

The results of the 2017 survey reveal that over more than four decades, finance managers continue to maintain their loyalty to the adoption of a portfolio of investment appraisal techniques in both strategic and non –strategic projects. The growth rate of using a combination of financial investment appraisal techniques (Figure 6) and risk analysis techniques (Figure 7) has expanded over the last four decades (1975–2017). The choice and use of financial analysis techniques and risk analysis techniques depends on the type of project being evaluated (Figure 4 and Figure 6). Findings of this study confirm previous findings of Alkaraan and Northcott (2006) that decision makers in large UK companies do not appear to use emergent analysis techniques widely (Figure 10 and Figure 11). Future research may re-examine the adoption of these techniques in different settings.

However, despite their perceived importance in this study, quantitative accounting controls may fail to connect with the kind of investment decision making required to bring strategic success. Indeed, it has been widely noted that financial evaluation techniques are inadequate for assessing strategic

investment proposals; they can only function as a guideline, since SIDM practices involve so many uncertainties, risks and judgements. A key insight from this study is that the achievement of integration between the firm's strategic investment projects and the overall organisational strategy forms a critical pre-decision control on managerial behaviour at an early stage in SIDM practices. Since, many strategic investment decisions are one-off, non-repeatable decisions, the information needed to support their evaluation is likely to be similarly unique. Sound SIDM practices require the support of a large amount of varied information, a significant proportion of which is collected and analysed prior to potential capital investment projects being considered, such as information related to strategic goal setting, risk adjusted hurdle rates and the design of appropriate organisational decision hierarchies. In order to understand the factors that shape SIDM practices and align them to organisational strategy, more attention is required to the choice and design of pre-decision controls and to the important role of strategic management accounting tools over the more traditional financial analysis techniques that have formed the focus of much prior empirical research.

Findings of this study raise a call for future research to examine SIDM processes in different settings to explore the relative impact of various organisational control mechanisms on SIDM practices. Also, to examine the influence of contextual factors (such as national culture, political, legal and social factors) on organisational control mechanisms. SIDM practices and processes have received significant attention from researchers, yet there is a lack of evidence in the literature about how companies approach strategic decision-making regarding divestments of some of their strategic investments. This type of strategic decision making is not less important than other types of SIDM practices. What techniques or mechanisms were widely used in evaluating the strategic decisions around such as divestments? What is the impact of key contextual factors on such strategic decision making? These questions raise suggest other avenues for future research.

Finally, findings of this study, however, remain within the context of UK companies. This study has its own limitations due to its time, location, respondents and sample selection, the size and the sector of the selected companies, and questions addressed. As the current study is based on survey data, it provides indicative results.

Acknowledgements

The author gratefully acknowledges helpful comments received from Professor Deryl Northcott (Faculty of Business, Auckland University of Technology, New Zealand), Professor Elaine Harris (Business School, University of Roehampton), Professor Robert Scapens (University of Birmingham), Professor David Otley (Lancaster University) and participants at BAFA 2019 Annual Conference.

References

- Abdel-Kader, M. G. and Luther, R. (2008). The impact of firm characteristics on management accounting practices: A UK-based empirical analysis. *The British Accounting Review*, 40 (1), 2–27.
- Abdel-Kader, M. G., and Dugdale, D. (1998). Investment in advanced manufacturing technology: a study of practice in large U.K. companies. *Management Accounting Research*, 9 (3), 261–284.
- Adler, R. W. (2000). Strategic investment decision appraisal techniques: the old and the new. *Business Horizons*, 43(6), 15–22.
- Alkaraan, F. (2017). Strategic Investment Appraisal: Multidisciplinary Perspectives. in Cary L. Cooper, Sydney Finkelstein (ed.) *Advances in Mergers and Acquisitions*, 16, 67 – 82
- Alkaraan, F. (2016). Strategic investment decision-making – scanning and screening investment opportunities: The expansion of Guinness in West Africa. *Meditari Accountancy Research*, 24 (4), 505 - 526.
- Alkaraan, F. (2015). Strategic Investment Decision-Making Perspectives. in Cary L. Cooper, Sydney Finkelstein (ed.) *Advances in Mergers and Acquisitions*, 14, 53 - 66

- Alkaraan, F. and Northcott, D. (2013). Strategic investment decision-making processes: the influence of contextual factors. *Meditari Accountancy Research*, 21(2), 117-143.
- Alkaraan, F. and Northcott, D. (2007). Strategic investment decision making: the influence of pre- decision control mechanisms. *Qualitative Research in Accounting & Management*, 4 (2),133-150.
- Alkaraan, F., and Northcott, D. (2006). Strategic capital investment decision-making: a role for emergent analysis tools? A study of practice in large UK manufacturing companies. *British Accounting Review*, 38 (2), 149–173.
- Arnold, G. C., Hatzopoulos, P. D., (2000). The theory-practice gap in capital budgeting: evidence from the United Kingdom. *Journal of Business Finance and Accounting*, 27 (5&6), 603–626.
- Brealey, R. A., Myers, S. C., Allen, F. (2008). Brealey, Myers, and Allen on Real Options. *Journal of Applied Corporate Finance*, 20 (4) 58-72.
- Berry, A. J., Coad, A. F., Harris, E. P., Otley, D. T., and Stringer, C. (2009). Emerging themes in management control: a review of recent literature. *British Accounting Review*, 41(1), 2–20.
- Bhimani, A. (2009). Risk management, corporate governance and management accounting: Emerging interdependencies. *Management Accounting Research*, 20(1), 2-5.
- Bisbe, J., Otley, D. (2004). The effects of the interactive use of management control systems on product innovation. *Accounting, Organizations and Society* 29 (8), 709 -737.
- Black, F., Scholes, M. (1973). The pricing of options and corporate liabilities. *Journal of Political Economy* 81 (3), 637–654.
- Bui, B., De Villiers, C. (2017). Business strategies and management accounting in response to climate change risk exposure and regulatory uncertainty. *The British Accounting Review*, 49, 4-24.
- Bui, B. and De Villiers, C. (2017). Carbon emissions management control systems: field study evidence. *Journal of Cleaner Production*, 166, 1283-1294.
- Busby, J. S., Pitts, C. G. C. (1998). *Assessing Flexibility in Capital Investment*. The Chartered Institute of Management Accountants, London.
- Busby, J. S., Pitts, C. G. C. (1997). Real options in practice: an exploratory survey of how finance officers deal with flexibility in capital appraisal. *Management Accounting Research* 8 (2), 169–186.
- Carr, C., Kolehmainen, K. and Mitchell, F. (2010). Strategic investment decision making practices: a contextual approach. *Management Accounting Research*, 21(3), 167-184.
- Carr, C., and Tomkins, C. (1996). Strategic investment decisions: the importance of SCM. A comparative analysis of 51 case studies in UK, US and German Companies. *Management Accounting Research* 7 (2), 199–217.
- Carr, C., Tomkins, C., and Bayliss, B. (1991). Strategic controllership—a case study approach. *Management Accounting Research*, 2 (2), 89-107.
- Cheung, J. K. (1993). Managerial flexibility in capital investment decisions: insights from the real-options literature. *Journal of Accounting Literature* 12, 29–66.
- Crittenden, F. and Derregia, M. (2015). Uncertainty, irreversibility and the use of ‘rules of thumb’ in capital budgeting. *The British Accounting Review* 47 225–236
- Cooper, D., Ezzamel, M., and QU, S. Q. (2017). Popularizing a Management Accounting Idea: The Case of the Balanced Scorecard. *Contemporary Accounting Research*, 34(2)
- De Villiers, C., Rouse, P., and Kerr, J. (2016). A new conceptual model of influences driving sustainability based on case evidence of the integration of corporate sustainability management control and reporting. *Journal of Cleaner Production* 136 (A), 78-85.
- Dixit, A.K. and Pindyck, R.S. (1995). The options approach to capital investments. *Harvard Business Review*. 73 (3), 105-115.
- Dobbs, I. M. (2009). How bad can short termism be? A study of the consequences of high hurdle discount rates and low payback thresholds. *Management Accounting Research*, 20 (2). 117-128
- Drury, C and Tayles, M. (1996). UK Capital Budgeting Practices: Some Additional Survey Evidence. *The European Journal of Finance*, 2 (4), 371-388.

- Elmassri, M. M., Harris, E. P. and Carter, D. B. (2016). Accounting for strategic investment decision-making under extreme uncertainty. *The British Accounting Review*, 48, 151-168.
- Emmanuel, C., Harris, E. and Komakech, S. (2010). "Towards a better understanding of capital investment decisions", *Journal of Accounting & Organizational Change*, 6 (4) 477-504.
- Graham, P., J. and Sathye, M. (2017). Does National Culture Impact Capital Budgeting Systems?, *Australasian Accounting. Business and Finance Journal*, 11(2), 43-60.
- Haka, S. (2007). A Review of the literature on capital budgeting and investment appraisal: past, present, and future musings. In: Chapman, C.S., Hopwood, A.G., Shields, M.D. (Eds.), *Handbook of Management Accounting Research*, Vol. 2. Elsevier, Oxford, 697–728.
- Harris, E. P., Northcott, D., Elmassri, M. M., and Huikka, J. (2016). Theorising strategic investment decision making using strong structuration theory. *Accounting, Auditing & Accountability Journal*, 29 (7), 1177-1203.
- Harris, E. P. (2014). Feel the risk: strategic investment decisions in an uncertain world. in Otley, D. and Soin, K. (Eds), *Management Control and Uncertainty*, Palgrave MacMillan, 343-377.
- Harris, E., Emmanuel, C.R., and Komakech, S. (2009). *Managerial Judgement and Strategic Investment Decisions – A Cross-sectional Survey*. Oxford: Elsevier, CIMA Publishing.
- Harris, E. P. and Woolley, R. (2009). Facilitating innovation through cognitive mapping of uncertainty. *International Studies of Management & Organization*, 39 (1), 70-100.
- Harris, E. P. (2009). *Strategic Project Risk Appraisal and Management*. Farnham, Gower.
- Harris, E. P. (2007). How managers construe risk in business acquisitions. *International Journal of Risk Assessment and Management*, 8, 1057-1073.
- Harris, E. P. (1999). Project risk assessment: A European field study. *British Accounting Review*, 31, 347–371
- Herath, S. K. and Indrani, M. W. (2007). Budgeting as a competitive advantage: evidence from SriLanka. *Journal of American Academy of Business*, 11 (1), 79-91.
- Hoque, Z. (2014). 20 years of studies on the balanced scorecard: Trends, accomplishments, gaps and opportunities for future research. *The British Accounting Review*, 46, 33–59.
- Huikka, J., Karjalainen, J., and Seppala, T. (2018). The Dynamism of Pre-decision Controls in the Appraisal of Strategic Investments. *The British Accounting Review*. (forthcoming)
- Innes, J., Mitchell, F., and Sinclair, D. (2000). Activity-based costing in the U.K.'s largest companies: a comparison of 1994 and 1999 survey results. *Management Accounting Research*, 11 (3), 349–362.
- Klammer, T. P. and Wilner, N. (1991). Capital budgeting practices: a survey of corporate use. *Journal of Management Accounting Research*, 3 (1), 113-130.
- Klammer, T. P. and Walker, M.C. (1984). The continuing increase in the use of sophisticated capital budgeting techniques, *California Management Review*, 27 (1), 137-148.
- Kumarasiri, J., Jubb, C. (2016). Carbon emission risks and management accounting: Australian evidence. *Accounting Research Journal*, 29 (2), 137-153
- Lefley, F. (1994). Capital investment appraisal of manufacturing technology. *International Journal of Production Research* 32 (12), 2751–2756.
- Ma, Y. and Tayles, M. (2009). On the emergence of strategic management accounting: an institutional perspective. *Accounting and Business Research*, 39 (5), 473-495.
- MacDougall, S. L., Pike, R. H. (2003). Consider your options: changes to strategic value during implementation of advanced manufacturing technology. *Omega* 31 (1), 1–15.
- Mikes, A. (2009). Risk management and calculative cultures. *Management Accounting Research*, 20 (1), 18-40.
- Malmi, T. and Brown, D. A. (2008). Management control systems as a package – opportunities, challenges and research directions. *Management Accounting Research*, 19 (4), 287-300.
- Northcott, D. and Alkaraan, F. (2007). Strategic investment appraisal, in Hopper, T., Northcott, D. and Scapens, R. (Eds), 3rd ed., *Issues in Management Accounting*. Pearson Education, London.
- Northcott, D. (1995). *Capital Investment Decision-Making*. London, Dryden Press.

- Northcott, D. (1991). Rationality and decision making in capital budgeting. *The British Accounting Review*, 23 (3), 219-233.
- Miller, P., O'Leary, T. (2005). Capital budgeting, coordination, and strategy: a field study of interfirm and intrafirm mechanisms. In: Chapman, C.(Ed.), *Controlling Strategy*. Oxford University Press, Oxford.
- Miller, P., O'Leary, T. (1997). Capital budgeting practices and complementarity relations in the transition to modern manufacture: a field-based analysis. *Journal of Accounting Research*, 35(2), 257-271.
- Pike, R. H. (1996). A longitudinal survey on capital budgeting practices. *Journal of Business Finance & Accounting*, 23 (1), 79-92.
- Pike, R. H. (1982). *Capital Budgeting in the 1980s: A Major Survey of Investment Practices in Large Companies*. Institute of Cost and Management Accountants, London.
- Sangster, A. (1993). Capital investment appraisal techniques: a survey of current usage. *Journal of Business Finance and Accounting*, 20 (3), 307-332.
- Scapens, R. W., Sale, J.T., and Tikkas, P. A. (1982). *Financial Control of Divisional Capital Investment*, London, CIMA.
- Schwenk, C. R. (1988). The cognitive perspective on strategic decision making. *Journal of Management Studies*, 25 (1) 41-55.
- Slagmulder, R. (1997). Using management control systems to achieve alignment between strategic investment decisions and strategy, *Management Accounting Research*, 8, 103-139.
- Stark, A. W. (1990). Irreversibility and the capital budgeting process. *Management Accounting Research*, 1 (3), 167-180.
- Stent, W., Dowler, T. (2015). Early assessments of the gap between integrated reporting and current corporate reporting. *Meditari Accountancy Research*, 23 (1), 92-117
- Van Staden, C. J. and J. Hooks. (2007). A comprehensive comparison of corporate environmental reporting and responsiveness. *British Accounting Review* 39(3): 197- 210.
- Verbeeten, F. H. M. 2006. Do organizations adopt sophisticated capital budgeting practices to deal with uncertainty in the investment decision? A research note. *Management Accounting Research*, 17 (1), 106-120.