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**Managerial Judgement and Risk Assessment in Strategic  
Investment Decisions (SIDs)**

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## Abstract

Managerial Judgement and Risk Assessment in Strategic Investment Decisions (SIDs) Abstract The theoretical definition of risk applies where possible outcomes are known and the probability of those outcomes can be estimated. Risk analysis techniques therefore focus on the effect of risk. Several surveys indicate that these techniques are normally complemented or dominated by subjective or intuitive assessments of risk, which has prompted a debate over a possible theory-practice gap.

When an alternative theoretical perspective of decision-making under uncertainty is adopted, managerial cognition of 'risk' embraces human information processing capabilities, group dynamics and consensus-building. This approach encompasses managerial attempts to recognise unpredictable events and to isolate their causes. Whether risk is seen from a cause or effect perspective may be gauged by examining empirical, especially field-based studies which suggest a theory-theory gap exists.

Emergence of this gap can be reconciled within the different stages of the strategic investment decision (SID) process. An emphasis on the cause of risk requires management judgements at lower levels in an organisation, at the project generation, business case and early screening stages, to be of fundamental importance. The subsequent effects of risk at the analysis and evaluation stage provide possibly complementary but secondary considerations for the SID. Given this increased emphasis on the causes of risk, future research possibilities are outlined in the concluding section.

# **Managerial Judgement and Risk Assessment in Strategic Investment Decisions (SIDs)**

## **Introduction**

Strategic investment decisions (SIDs) continue to be of critical importance to modern business enterprises. Adoption of a strictly economic paradigm enables finance theory to emphasise sophisticated risk assessment techniques to resolve these decisions. This focus on the effects of risk ignores the organisational context in which SIDs occur and the potential influence managerial and strategic considerations may exercise.

Recognition of SIDs as a process, in which evaluation and analysis form but one stage only, helped to introduce the organisational context. Implicit in this view is the involvement of, potentially, several levels of management who interpret corporate strategy and assess risk, particularly at the early stages of the SID process. How these managers perceive risk is therefore of considerable significance if consequent stages of the process are to be meaningful. Does personal risk replace strategic, company-wide considerations or are there ways in which corporate risk assessments are transmitted to guide divisional level managers' judgement?

Taking an alternative theoretical perspective offered by prospect theory, which addresses how the human mind works, problems with an individual's interpretation of probabilities emerge. A decision taker's risk assessment incorporates a detection of the causes of unpredictable events, which may be termed 'risk drivers'. This focus on cause admits human information processing, group dynamics and consensus building to the SID process. By examining recent field based studies, some of these features may help explain how companies manage the process and divisional management assessment of risk. The aim is therefore two fold: (a) to clarify whether risk has a causal as well as an effect focus and (b) to commence a synthesis of field studies to detect how lower level management assessment of risk is carried out in practice.

The paper is organised in the following way: a brief history of the SID process and the survey evidence of risk appraisal techniques is examined: rationality in decision-making is next questioned before prospect theory is presented and a group dimension added. The next section addresses recent field based studies and analyses these using the risk as cause focus. A final section places the alternative perspectives of risk as cause and effect in the context of the SID process. At the earlier stages of the process, future research may usefully examine the human information processing, group dynamics and consensus building attributes in any fieldwork. This may help explain how divisional management risk assessment is (in)formed.

## **A brief history of the SID process**

It has been suggested that academics in the field of finance take too narrow a view of capital budgeting (King, 1975). An example of this traditional or narrow view of finance might be Levy and Sarnat, who prefer not to deal with strategy at all, and continue to assume that decisions will be made based on economic evaluation alone. This is understandable where shareholder wealth maximisation is assumed to be the primary objective of the firm (Levy and Sarnat, 1994). Likewise organisational behavioural issues are largely ignored as irrelevant to finance theory within this economic paradigm.

In the fifth edition of Lumbly's book, he includes a chapter on 'strategic planning and the finance function' (Lumbly, 1994, p25-37), which does recognise a link, but the strategic context for decisions does not permeate the rest of the text. The links between financial and strategic analysis have been emphasised by some academics within the finance field (Mills, 1994; Tomkins, 1991; Ward, 1993), but only relatively recently. Perhaps this is largely due to the development of business strategy as a newer discipline than accounting and finance (Mintzberg, 1994).

King offered a view which placed investment appraisal within a strategic decision making process. The process described by King was based on his analysis of a case involving the addition of extra capacity in the chemicals division of a diversified group . His process model therefore has an empirical basis (King, 1975).

He depicted the process as a sequence of six stages:

1. Triggering (recognition of opportunities)
2. Screening (should the opportunity be pursued?)
3. Definition (what form should the project take? and is it strategically acceptable?)
4. Evaluation (search for information and financial analysis)
5. Transmission (build up of commitment)
6. Decision (final check on worth of project and formalisation of commitment)

Whether it is the case itself or the diagrammatic representation of the process, there appear to be no possible feedback loops. (So, whilst it does encompass more than financial analysis shown as part of the evaluation stage, it is far from an ideal model). Nevertheless this represents one of the first attempts to recognise investment appraisal in the organisational context of the enterprise.

Pike and Neale depict a simple capital budgeting system as a five stage process (Pike and Neale, 1996, p183) labelled as:

1. Determination of the budget
2. Search and development
3. Evaluation
4. Authorization
5. Monitoring and control

This model allows a return from the evaluation stage to the search and development stage as one of four feedback loops, and allows for the possibility of an idea being generated out of the normal sequence, at stage 2, which causes management to consider an increase in the budget by looping back to stage one. It does not stop at the decision point, but also includes a monitoring and control stage (post audit), which loops back to the evaluation stage in the process. This appears to be an improvement on earlier presentations of the process. In a divisionalised organisation the simple model may need extending to show the location of activity at the different stages. It may be assumed that all but the authorisation stage takes place at the divisional level, and that the role of group executives is to authorise the capital budget and make final decisions on large projects based on information provided by divisions (Mills and Herbert, 1987).

In today's business environment, with the huge sums needed to invest in advanced manufacturing technology (Eisenhardt, 1989), the concept of authorising an annual capital budget implied by Pike and Neale's process model is possibly outmoded, or restricted to small sums which would not fit the definition of an SID.

An alternative view is offered in the strategic planning literature. Dyson, for example, sets out eleven elements in the strategic decision making process (Dyson, 1990, p7), which are also shown in diagrammatic form, with feedback loops. The book focuses on six of these, which are discussed in order (by contributing authors) and finally linked with analytical techniques (p308). The six key stages are:

1. Objective setting and review
2. Strategic option formulation

3. Assessment of uncertainty
4. Corporate system model
5. Performance measurement
6. Gap analysis and selection

Dyson provides a matrix which positions fourteen analytical techniques in terms of their primary and secondary impact at each stage. Capital investment appraisal is technique number eleven, and is shown as having primary impact at stages 5 and 6, and secondary impact at stages 1 and 3. Risk analysis (defined in the book by the inclusion of a paper by Hertz, 1964) is technique number 7 and is shown as having primary impact at stage 3 and secondary impact at stages 4 and 5 in the process.

This approach separates out the financial analysis (performance measurement) from the decision analysis (gap analysis and selection), which overcomes Jones and Dugdale's criticism of accountants confusing measures and criteria (Jones and Dugdale, 1994).

It also positions the techniques which are assumed to be in the accountants' domain as a minority of the fourteen techniques which may be applied in strategic analysis. This highlights one of the weaknesses of capital budgeting surveys (Drury et al., 1993; Ho and Pike, 1991; McIntyre and Coulthurst, 1986; Mills and Herbert, 1987; Pike, 1982; Pike, 1996; Sangster, 1993; Scapens et al., 1982), in that almost all questionnaires were targeted at accountants or finance directors.

figure 1 here

The model shown in figure 1 is another interpretation of the strategic investment appraisal process (Harris, 1999: p352). It shows that very little of the process takes place at Group level (stage 6), but is located within the divisional domain. Executive judgement is exercised at divisional level at two stages (3 and 5), an 'early screening' stage, once there is sufficient information to make a judgement as to whether the project is worth investigating fully, and the more formal stage when the decision is made to place the project on the Group board agenda. It is also apparent that divisional management judgement is exercised at stages 1, 2 and 4.

The focus of this paper is on the importance of managerial judgement in the SID process (stages 1 to 5 which require subjective judgement in figure 1), and where in the process risk may be viewed as cause, and where it may be assessed in effect terms.

### **Risk as Effect**

Before exploring managerial judgement in assessing risk in SIDs, the historical context of risk in SIDs is summarised from the literature. In reviewing the theoretical proposition as to how risk should be taken into account within the *capital investment appraisal* process, a definition of *risk* in this context is drawn from CIMA:

"A condition in which there exists a quantifiable dispersion in the possible *outcomes* from any activity." (CIMA, 1996 p101, emphasis added)

This definition is brief and does not distinguish risk from uncertainty, but states that risky activities may have a range of possible measured outcomes, rather than assured or certain outcomes. It assumes that outcomes can be measured. The terms uncertainty and risk are used interchangeably in much of the literature, but the main distinction, where one is made, is that uncertainty includes all manner of unpredictable events.

Risk may only deal with outcomes which are known to be possible where the chance of occurrence may be estimated. Kaye distinguishes risk from uncertainty by suggesting that risk can be identified and measured, whereas uncertainty is unpredictable and cannot be estimated in terms of probabilities (Kaye, 1994, p118). In

choosing between a number of risky alternatives in business, there are theoretical approaches which managers may take to analyse the risk.

These are based on the ‘prescription’ of the net present value rule (Hirshleifer, 1958; Tobin, 1958) and the use of simulation in modelling the cash flow (Hertz, 1964), measuring the monetary outcomes expected to flow from the project compared with the corporate financial objective of shareholder wealth maximisation. This follows the optimisation principles of economics, and provides a means for managers to take strategic investment decisions which are economically rational.

However, the focus on financial *output* measures ignores three key problems. Firstly the problem of collecting and validating the inputs to the model e.g. base assumptions about costs, volumes and productivity. Secondly the problem of evaluating the non-monetary aspects, both in terms of the costs and benefits to the organisation, and in terms of the attitudes and feelings of the decision-makers.

Third, but equally important, is the problem of isolating the decision point. The NPV rule makes an assumption about the start of the project (time = 0) and ignores the planning phase, from identification of the idea or strategic option, through project definition and negotiation, to the decision point (figure 1). As such, it is a static model, which fails to reflect the dynamic nature of business, and the human tendency to form early judgements, however subjective, on the desirability of a project.

These problems emerged in a variety of empirical studies which found a low level of usage of the prescribed theoretical techniques. Table 1 shows the main findings on the use of risk analysis techniques of three surveys (see also table 2 for Pike’s trend analysis). Whilst Smith and Murray’s regional survey is obviously based on a smaller sample and does not claim to be as generalisable as the other two, it is comparable with Drury et al’s study in the size and type of organisation, and the qualification and role of respondents. The percentages shown are the proportion of respondents who claimed to use the specified techniques sometimes, often or always.

Table 1 Risk Analysis Techniques

	Ho & Pike, 1988	Drury et al, 1992	Smith & Murray, 1996
	n = 142	n = 240	n = 83
Simulation	8%	5%	1%
CAPM/Beta analysis	15%	3%	4%
Probability analysis	30%	38%	30%
Sensitivity analysis	63%	75%	80%
Certainty equivalent	n/a	n/a	4%
Subjective/intuitive: increase/decrease discount rate require shorter/longer payback conservative cash flow forecasts	68%	45% 77% 72%	see case study analysis

Whilst the surveys are not directly comparable, given the sampling frames and nature and purpose of the questionnaires, the table does show similar low proportions of respondents using what may be described as sophisticated approaches (the first five rows) and high proportions using subjective approaches (the last rows). The certainty equivalent method was only specified in one survey, and as a formal method which is rarely recommended in the texts, it is understandably little used. Scenario analysis was not differentiated from sensitivity analysis in the surveys, but could be classified with the subjective or intuitive approaches. The latter are not included in the table in the Smith and Murray survey as they were covered by open ended questions and subsequent case study analysis.

As the studies were carried out at four year intervals from 1988 to 1996, there is an indication from the surveys that the use of sensitivity analysis has been increasing, with the relevant proportion of

respondents rising from 63%, to 75% to 80%. The proportion of respondents claiming to use simulations or beta analysis appears to have reduced, but these apparent trends may be due to the difference in sampling frames and the fact that Drury and Smith asked more divisional level accountants and included smaller organisations in their surveys.

Pike claims to have detected a more reliable trend from his surveys.

Table 2 Pike's trend analysis of Risk Appraisal Techniques (n=98)

Year of Survey	1975	1980	1986	1992
Firms which:	%	%	%	%
Shorten payback period	25	30	61	60
Raise required rate of return	37	41	61	65
Use probability analysis	9	10	40	48
Use sensitivity analysis	28	42	71	88
Use beta analysis	0	0	16	20

Source: (Pike, 1996)

There is increasing use of all techniques shown here, whether subjective or analytical, which shows sensitivity analysis as the most notable increase. Whilst the percentages in Drury et al's study differ, due to the different sampling frame used, the trend in use of sensitivity analysis appears to have continued. Pike puts this down to the increasing use of spreadsheets for DCF analysis which make sensitivity analysis easier. Another view might be that managers find sensitivity analysis easier to interpret, particularly when interpreted as scenarios, with less complicated statistical analysis than the probabilistic approaches.

Pike points out that whilst there is an increase in the use of beta analysis, CAPM has come under criticism both theoretically, as a predictive model (Fama and French, 1992) and practically (Lowenstein, 1991) in the US. Dimson and Marsh continue to advocate its use in the UK and to promote the London Business School's risk measurement service, whilst the academic debate continues. The CAPM only takes account of the systematic risk reflected in the cost of capital, but it continues to influence the organisational hurdle rate which the company might set for specific projects (Broyles, 1999).

### **Rationality in Decision-Making**

An important contribution was made by Herbert Simon on the boundaries of human rationality (Simon, 1957). He later extended his theory of *bounded rationality* and applied it to business decisions (Simon, 1978; Simon, 1979). He suggested that humans can only make sense of the data available to them within the context of what they already know and have experience of. The reasoning that a person will use when faced with making a choice would therefore depend upon his or her local knowledge and experience, such that a different person will view the same choice differently, as he or she will have a different set of prior knowledge and experience.

Simon challenged the assumptions about man's ability to be rational, inherent in the neo-classical theory of economics. He did acknowledge the improvement on cardinal utility theory made by the development of subjective expected utility (SEU) theory. However, in view of empirical evidence, he found:

"it is hard to take SEU seriously as a theory of actual human behavior in the face of uncertainty"  
(Simon, 1978, p9).

He suggested that the gap between normative and real behaviour would be greater where the uncertainty and complexity of the decision were greater, as the capability of the decision maker to search for and process sufficient information would be more of a constraint. Simon separated economic rationality into substantive rationality, which dealt with the principle of evaluating alternatives in terms of their contribution to the economic goal, and procedural rationality, which dealt with the search for and use of information as a

basis for evaluation and decision. He suggested that the use of computers would advance man's capacity for procedural rationality.

In dealing with procedural rationality, from an economics perspective, Simon presented the mind of the decision maker and the attention to be given to the decision as a scarce resource, about which insufficient was known. He concluded that theory from other disciplines, such as cognitive psychology, should be borrowed to help explain decision-making behaviour and models of rationality.

David Cooper challenged the assumption of economic rationality in investment appraisal from a sociological perspective (Cooper, 1975). His analysis of the apparent theory practice gap in capital budgeting led him to reject the possible hypothesis that it was due to the ignorance of probability theory and cash flow estimation techniques in firms, in favour of a social subsystem explanation. He argued that the economic rationality assumption did not hold because the firm could not behave as a decision making entity separate from the individuals employed within it. He stated:

“a firm does not possess a mind of its own and, unless we are willing to make the restrictive assumption that there exists some mechanism to ensure that all participants in a firm will behave in a manner consistent with one well ordered preference function, no immediate meaning can be attached to the concept of maximising a firm's utility.” (Cooper, 1975, p200)

The basis for this argument rests upon Cyert and March's behavioural theory of the firm (Cyert and March, 1963), evidenced by the observations of a number of studies where the self-interest of individuals and sub-systems within the structure of the firm provided more motivation for their actions than often vague corporate goals. Cooper suggests three patterns of behaviour associated with the different roles that managers might play in organisations, which added to Bower's earlier contribution on investment as a social process (first edition in 1970 of Bower, 1986).

Simon Hargreaves-Heap and others also recognised that the neoclassical economics assumption that a single logic or criterion would drive decisions ignored conflicting evidence from the social sciences (Hargreaves-Heap, 1989; Hargreaves-Heap et al., 1992). The human tendencies to be motivated by mental images of the attractiveness or otherwise of an option, and exercise a kind of 'animal instinct' or intuition, along with the excitement of surprise, are all given as phenomena which influence individuals in making choices and taking action. This makes the risk attitude of the individual vary, not just from one decision to another, but also according to how the options are framed, and the politics involved in the decision.

Jones and Dugdale also deal with rationality from a sociological perspective, and use four facets of rationality to explore “the meanings accountants attach to techniques, information and decision processes in investment” (Jones and Dugdale, 1994, p5). These are objective rationality (pure reasoning based on objective logic), subjective rationality (practical reasoning based on the individual's perceptions and values), inter-subjective rationality (shared reasoning based on occupational or organisational norms), and positional rationality (self-interested reasoning based on the position of individuals and groups in social structures).

They undertook semi-structured interviews with five accountants, one academic and four practising accountants with different amounts and types of experience. With such a small sample, personally selected, it is dangerous to generalise about the results. However, the findings of the discourse analysis revealed that the academic's views were dominated by objective rationality, whereas the practitioners views spanned the four types of rationality without any dominant form of reasoning. This formed the basis for the conclusion that academics and practitioners view investment appraisal very differently.

At first this seems intuitive, but it may not apply to all accountants. Academic and practising accountants come from a range of different backgrounds. Academics in business schools where previous practical experience may be an essential recruitment criteria might be expected to think differently from those in traditional university departments. Practitioners who gained a first degree in Accounting or a higher degree

e.g. MBA, may think very differently from those who studied for professional qualifications whilst working, without attending university.

Despite this, the warnings about the dangers of academics failing to locate their theories in practical contexts or being sufficiently sensitive to how their own views are constructed may well be perfectly valid. We can all learn by appreciating the bounds of our own rationality. The conclusion here is that theories of rationality challenge the assumptions of the optimisation rules of neoclassical economics theory.

## **Risk as Cause**

Risk as cause fits within the wider definition of uncertainty. An advance in the theory of decision-making was made by Tversky and Kahneman, which recognised the heuristics and biases that decision makers use when choices are made under conditions of uncertainty (Kahneman and Tversky, 1979; Tversky and Kahneman, 1974). They found that people have the tendency to simplify a complex problem and apply a rule of thumb rather than attempting a sophisticated mathematical programming type of solution. In their early research (Tversky and Kahneman, 1974) the subjective assessment of probabilities was explored by asking people to make a series of judgements.

This revealed three heuristics which were employed in making judgements under uncertainty. The first was *representativeness*, which was used to classify objects or events in terms of a set of characteristics familiar to the research subject. For example, research subjects held stereotypical views of the type of person who would (in their experience) have a particular role, which they then used as a reference point.

When asked to identify the most likely job role that someone described to them might hold, they sought to match these characteristics in preference to using the quantitative data on how many farmers or librarians there were (to compute a probability). So the probability of the person described fitting a particular class was ignored in favour of the use qualitative data drawn from matching the stereotype.

The second heuristic was *availability* of experience as a reference point. For example, the number of people known by the research subject to have suffered a heart attack influenced their judgement more than the quantitative data given, when asked to assess the likelihood of such an event occurring. This also covered the ease of access to information, where research subjects were found to search their memory based on the first rather than third letter of a word.

The third heuristic was *adjustment and anchoring*, where people made estimates by reference to an initial value (the anchor), plus or minus an adjustment, to reflect new information. The adjustment was often found to be insufficient, which was explained as partly due to a reluctance to move away from the base value. Such problems of calibration could be influenced by the process of elicitation of the estimate, or the motivational effect of rewarding correct answers or penalising incorrect answers.

Together with further similar research and a re-analysis of the work of others, these findings destroyed the descriptive capability of subjective expected utility (SEU) theory, by violating the axiom of economic rational choice. An alternative *prospect theory* emerged from Tversky and Kahneman's observations (Kahneman and Tversky, 1979).

They defined a prospect as a gamble or choice between risky alternatives. In SEU theory, the utilities of outcomes are weighted by their probabilities. So the value of option A, where the outcome would either be a win of a sum of 1,000, or nothing, with equal probabilities, would be 500 (50% x 1,000 plus 50% x 0). When research subjects were asked to choose between this risky alternative or option B with a sum of 450 assured, SEU would point to option A as the rational choice (with the expected value of 500 exceeding 450), and option B as the risk averse choice.

Tversky and Kahneman set out to show up the three main tenets of SEU theory as problematic by analysing a series of effects. The first, the *certainty effect* shows that people over-emphasise certain outcomes in making choices where expected values are similar. However, where the possible gain is high enough, even where the probability is low, many people are willing to take a gamble if the stake is low. A good example in present day life is the purchase (for a small sum) of a lottery ticket, where the chance of winning is minuscule, but the possible gain is of such magnitude, that it tempts people into risk seeking behaviour.

Another example of apparently irrational behaviour is the purchase of loss insurance, where the cost of premiums is far greater than the expected actuarial costs, when the risk statistics are computed. This risk averse behaviour is noticeable where losses rather than gains are concerned, which is labelled the *reflection effect*. Neither would be predicted by the SEU theory, and shows up its weakness in failing to capture common attitudes to risk.

In multiple stage problems, where a decision tree might be used to represent the outcomes, where ultimate outcomes are contingent upon the outcome of a prior event, the difference between SEU theory and observed phenomena was marked. Tversky and Khaneman observed that people isolated the change or movement from a reference point and ignored any factors which were unchanged. They labelled this the *isolation effect*.

Together these three empirical effects identified the lack of applicability of the normative SEU theory in practice, which led them to develop their alternative descriptive theory. Kahneman and Tversky made the significant claim that their *prospect theory* is compatible with the way the human mind works.

From their trials they observed that we have a tendency to evaluate conditions in relation to our experience, using a reference point or anchor, and make adjustments from that point. Examples given include our reactions to brightness and loudness, which we evaluate by comparison with the brightness and volume perceived from our range of past experiences and adaptation from our own norm (Kahneman and Tversky, 1979, p277). In prospect theory, weights are used to infer preferences, but they are not the same as probabilities, rather they are the respondents reactions to stated probabilities. These “decision weights measure the impact of events on the desirability of prospects, and not merely the perceived likelihood of these events” (Kahneman and Tversky, 1979, p280).

Prospect theory could be viewed as an extension or improvement to SEU theory, adding a weighting scheme to the probabilities, or as a radically different alternative. If one takes the view that prospect theory turned what was a normative theory which was not reflected in practice, into a descriptive theory, then it could be seen as bridging a theory practice gap. However, that is not how the authors saw it, in their later work on prospect theory. In a later paper they clearly stated that “no theory of choice can be both normatively adequate and descriptively accurate” (Tversky and Kahneman, 1986, pS251).

After reviewing the failures of the normative rules to apply in practice, and the phases of framing and editing and of evaluation in prospect theory, they concluded that future research should treat the development of normative and descriptive theories as discrete endeavours. They continued to conduct experimental studies to build upon their descriptive model.

One of the important findings of the 1986 paper was the impact which the framing of prospects (definition and description of the opportunities) had on the evaluation phase and therefore ultimate choice. Over a number of studies they found that decision makers placed more emphasis on the initial information about the choice (*primacy*), or on the most recent information (*recency*), rather than taking a balanced view of all the data. The effects of *primacy* and *recency* in the human processing of information made an important contribution, which added to Simon’s conclusion that the search for and use of information was important, and similar views expressed by Libby (1981).

Other researchers made valuable additions to prospect theory and the heuristics and bias observed in decision making. Samuelson and Zeckhauser introduced the term *status quo bias* to describe the

phenomenon of using the status quo or 'do nothing' option as a reference point or anchor in decision analysis (Samuelson and Zeckhauser, 1988). This was explored further by Tversky and Kahneman in their study on reference dependence (Tversky and Kahneman, 1991), but as this focused on consumer choice, it added little to our knowledge of SIDs.

The main contribution made by Tversky and Kahneman towards the understanding of the behavioural aspects of decision-making, and how people evaluate risk and uncertainty, was the role of bias and heuristics and the importance of information processing and the framing of decisions. The main criticism of this style of research, using an experimental approach, is the problem of how to simulate and control for the many complexities of the real decision environment. The other weakness in terms of its relevance to an organisational context, is the focus on the individual, where decision-making in an organisational setting involves groups and hierarchical decision-making systems.

The role of bias in framing strategic decisions continues to attract the attention of both academics and practitioners. Hodgkinson et al. (1999) conducted an experimental investigation (in a field-based setting) into the use of causal cognitive maps in strategic decisions to examine whether such use might reduce the effect of framing bias. They found that cognitive mapping prior to choice did reduce bias. More work is needed in this area to support the prescriptive validity of their findings that cognitive mapping improves the quality of strategic decisions.

March and Shapira (1987) found that managers interviewed in a survey in US and Israel viewed 'downside' variation as risk more than 'upside', and attached greater importance to the magnitude of the downside outcome than to its probability. These findings concurred with Tversky and Kahneman's in terms of the loss aversion observed. Managers viewed risk as a multidimensional phenomenon, but 42% of executives interviewed in the Shapira study felt that "there was no way to translate" it "into one number" (March and Shapira, 1987, p1408).

They also found a positive attitude to risk in that "risk taking is valued, treated as essential to innovation and success. At the same time, however, risk taking is differentiated from ... gambling" (p1413). They discovered an element of what they described as 'management conceit' about the way their respondents thought that good managers could take considered risks and somehow 'control fate', showing more successful than unsuccessful outcomes.

Payne, Bettman and Johnson made a helpful contribution to the understanding of decision theory with their review of the behavioural literature from 1983 to 1991. Whilst it was largely written by psychologists for psychologists, it also recognised the contributions from economics, statistics and other fields.

As a subdiscipline of psychology, they position behavioural decision research (Payne et al., 1992, p89) as almost unique:

"because it often proceeds by testing the descriptive adequacy of normative theories of judgment and choice; in doing so, it makes substantial use of psychological concepts in general, and cognitive mechanisms in particular."

They relate the literature to the constructive nature of human preferences and beliefs and the contingent nature of decision-making. They discuss the work of Tversky and Kahneman quite extensively and the problem of intuitive vs. statistical or analytical reasoning. It is suggested that most decision takers make use of both intuitive (fast human data processing which occurs largely in the subconscious mind) and analytical (slower thought processing, which occurs as a conscious process), though fast computerised analysis can aid the latter.

Payne et al. suggest that decision makers may use their perceptual apparatus for noticing the characteristics of the alternative opportunities, and the analytical frameworks such as cost benefit analysis to decide how to exploit those opportunities, thus integrating intuitive and analytical approaches (Payne et al., 1992, p116).

They recognise the findings of Tversky and Kahneman in how decision makers use their own weightings in applying analytical techniques (the role of human information processing).

Information processing limitations may be overcome by changing the information environment. One example where this is widely known to have affected decision making is the provision of additional information to shoppers in supermarkets to support the buying decision. Earlier research is cited by Payne et al., but the more recent changes observable are the unit price information (now displayed in addition to pack prices across the product ranges) and nutritional information on packaged foodstuffs so that price or health sensitive decisions (e.g. on genetically modified ingredients) may be made.

Another example which may be familiar to those people who reside in geographic areas where the levels of radon gas are high<sup>1</sup>, is the publicity material circulated to encourage people to decide to take risk mitigation action (Smith et al., 1995). The possible consequences of the 'do nothing' option are stressed, with information on the added risk of cancer has been shown to be effective. This obviously supports earlier work on the framing of decisions (Tversky and Kahneman, 1986).

Payne et al. suggest two approaches to changing the information environment, one reactive and one pro-active. The former approach is to determine how decision makers currently process information and make that processing easier (e.g. by reformatting information in a more user-friendly way). One could argue that the supermarket pricing information would fall into this category, though Payne et al. classified earlier work in this area as more pro-active as it encouraged specific brand selection.

The more pro-active approach is to determine types of processing one seeks to encourage and design information to facilitate desired behaviour. The radon risk information would fall into this category, in the interests of national health policy. Another application is the provision of decision analysis techniques to help people to break down and solve complex decisions, for example contingency tables or matrices. Sensitivity analysis is an example given of a method "for eliciting the beliefs and values necessary to operationalize decision models" (Payne et al., 1992, p119).

The arguments for using more actuarial (based on probabilities) than clinical judgement (human information processing) in decision making cited by Payne et al. were from work undertaken in the context of psychiatric consulting (Dawes et al., 1989), so have limited relevance to SIDs in business.

Payne et al. conclude that the role of information and its processing is crucial in decision making and that task complexity and the measurement of values are also important. They clearly believe that cognitive psychology has a very important part to play in furthering decision theory, and seem unperturbed by the dominance of research using 'laboratory experiments' and the scarcity of research carried out in naturalistic settings. Their final comment was that:

"Behavioral decision research continues to reflect a rich interplay between basic and applied disciplines and between descriptive and prescriptive concerns." (Payne et al., 1992, p123).

Their review served to highlight the role of intuition, and the information environment, as generic themes.

Holloman discussed the behavioural aspects of decision making and characterised three domains (Holloman, 1992). The domain of the 'head' was characterised as an analytical process, based on prescriptive theory to solve structured problems where alternatives were known. The domain of the 'heart' was characterised as a highly personalised process, reflected in descriptive theory, to solve unstructured problems. The third domain, of 'head and heart' was characterised as an intuitive, experience based process, following a heuristic model, to solve partly structured problems. Simon's three models of man (Simon, 1957)

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<sup>1</sup> High levels of radon gas can be potentially harmful to people living or working in poorly ventilated properties, where the incidence of cancer has been greater than that for the general population. Publicity material explaining the risks involved, promoting free radon tests and offering guidance on mitigation actions has been distributed in these high risk areas, which includes Northamptonshire in the UK.

were fitted to the domains as 'economic man' (head), 'social man' (heart) and 'administrative man' (head and heart).

He presented arguments as to how each could be perceived as rational, though he also gave counter arguments as to why the economists may call them rational, irrational and nonrational, respectively. He went on to argue the case for intuition and for personalised decisions, with more strength in the former, before concluding that for many reasons, especially the time pressure, volume of decisions and their relative significance, most decisions take place in the 'head and heart' domain, using a combination of analysis and judgement. His argument is difficult to refute.

Accepting the argument that decisions are made cognitively by reference to heuristics at a stage when decisions are first framed (i.e. early in the SID process), and are therefore influenced by how the decision is framed and what information is available in both the 'head and heart' domains, managers may be expected to demonstrate these aspects of personal judgement when observed in organisational settings.

Before reviewing field studies to establish whether this is the case, an additional aspect relevant to the context of SIDs in organisations is that of the decision being viewed as a collective rather than individual activity.

### **Group Decision-Making and Consensus**

Further contributions from the behavioural literature, relevant to the focus on managerial judgement, are concerned with decision-making as a group rather than an individual process, and the issue of consensus. Whilst it is important to understand how individuals process information and think about risk in decision making, the framing, appraisal and choice in SIDs in large organisations involve group processes. The effectiveness of those group processes has been investigated from a variety of perspectives. Jay Hall, an American social psychologist, observed:

“Group decisions often are frustrating and inadequate. All members want agreement, but they also want to make their own points heard” (Hall, 1971, p51).

Despite the obvious problems of a group of people reaching consensus, Hall argues:

“there can be great strength in group problem-solving”.

In his experimental research with college students, Hall found that synergy in groups, which improved their decision making performance, came not from the length of time the group had been established, but from those who had received formal group effectiveness training. However, his earlier study with natural groups of business managers revealed better performance when they worked in established groups than in ad-hoc groups, when there was no control for training. This suggests that established groups of business managers may have developed their group effectiveness without necessarily receiving the formal training which college students needed.

Hall noted the difference in the way that more established groups of managers handled conflict. He found that groups which had higher levels of initial conflict out-performed those with less initial conflict of opinions. This led him to conclude that “A wide variety of opinions is beneficial to an established group, but disruptive to an ad-hoc group” (Hall, 1971, p52).

Hall developed a set of group decision instructions designed to help groups reach consensus. It began with the following definition of consensus:

“Consensus is a decision process for making full use of available resources and for resolving conflicts creatively. Consensus is difficult to reach, so not every ranking will meet with everyone's *complete* approval. Complete unanimity is not the goal - it is rarely achieved. But each individual should be able to accept the group rankings on the basis of logic and feasibility. When all group

members feel this way, you have reached consensus as defined here, and the judgement may be entered as a group decision.” (Hall, 1971, p54)

The rules which followed have been used by other researchers as a basis for instructions issued to participants (see for example Schweiger et al., 1986). Hall presented convincing evidence to support his conclusion that “when they follow a few brief instructions, decision-making groups can be expected to do better than even their best members” (Hall, 1971, p88). He suggested that ineffective groups might not only have imperfect ways of dealing with conflict, but may also be pessimistic about their own potential.

Having considered Hall’s work on the source of strength in group decision making, it was also around 1971 that Janis was analysing the weaknesses for the first edition of his work on ‘groupthink’, which was later revised and enlarged (Janis, 1982). He was also an American psychologist, but his ‘research subjects’ were politicians, and his ‘case studies’ were US government fiascos such as Pearl Harbour and the Vietnam war. It was from post hoc analysis of published information on these political fiascos that Janis identified the phenomenon of *groupthink*. He described the central theme of his groupthink hypothesis and analysis as:

“The more amiability and esprit de corps among the members of a policy-making-in-group, the greater is the danger that independent critical thinking will be replaced by groupthink, which is likely to result in irrational and dehumanizing actions directed against out-groups” (Janis, 1982, p13)

He qualifies his groupthink theory by stating “I do not mean to imply that all cohesive groups suffer from groupthink, though all may display its symptoms from time to time.” (Janis, 1982, p12). The applicability of Janis’ theory outside the context of government and the ‘US war machine’ is questionable. In a business context, the assumptions Janis makes may not apply.

One of the important characteristics of the type of decisions on which Janis tested his groupthink hypothesis was their ‘one-off’ nature, where learning from previous similar decisions was limited. In SIDs, each investment opportunity may be unique, but they may be classified by a project typology (Harris, 1999), and learning is a key element in the process, and not just via post audit.

The point which both Hall and Janis clearly agreed upon was the positive effect that an acceptance of conflicting views and the open-ness of argument could have on the performance of the group. The other point upon which they appear to agree is the positive effect of having group members who understand group dynamics, whether by formal training or not.

Schweiger, Sandberg and Ragan studied group approaches in strategic decision making, comparing the consensus approach (based on Hall) with two alternatives (Schweiger et al., 1986). They concluded from a laboratory experiment with MBA students, that dialectical inquiry and devil’s advocacy approaches were superior to consensus-seeking, and that some conflict in a decision-making group was healthy. The limitations recognised by Schweiger et. al. included the normal issue in laboratory experiments of using a group of students as a proxy for ‘real-life strategic decision makers’. They also recognised that normal decisions would take place over a longer period of time, with participants sourcing some of their own information.

What they did not recognise was the fact that many business decisions involve more than one group. In particular SIDs may go through group processes at three or four levels in a divisionalised organisation, where the conclusions of the originating group are then questioned as the proposal progresses up the management hierarchy. This ‘impetus’ was identified by Bower (1971 first edition of Bower, 1986) well before Schweiger’s study, yet this structural issue is rarely mentioned in the ‘experimental’ literature.

Over the last ten to fifteen years there has been a growing body of research designed to increase the effectiveness of group decision making in business, emanating from the information systems field. As information processing plays a large part in SIDs, it follows that computer technology should have been harnessed to systematise this processing. Much of the theory of decision support systems built up when

manual systems were more prevalent. One of the pioneers of group decision support systems (GDSS) theory recognised the value of both manual and computer systems was George Huber.

He set out the objective “the purpose of group decision support systems is to increase the effectiveness of decision groups by facilitating the interactive sharing and use of information among group members”. He also made the point that this increased effectiveness being achieved by using a GDSS “in conjunction with proven group management techniques” (Huber, 1984, p196). Huber saw the increasing complexity of the decision environment and the reluctance of managers to spend more time in meetings instead of in other managerial activities, as the two driving forces behind GDSS development. In the early days of development there was a clear role for a GDSS facilitator, an “expert on when and how the GDSS technology can be drawn upon to facilitate the group’s endeavor” (Huber, 1984, p198).

He argued for ‘real time’ systems, where group members could see the effect of their various opinions on relevant assumptions, such that differences of opinion could be resolved within the group meeting, leading to better consensus. This was argued strongly in the case of numeric information, such as cash flow forecasts, where ‘what-if’ analysis might be carried out during a group meeting. The facts that “meetings are extremely verbal environments” and that “thoughts are primarily shared and modified, not numbers” (p201) create demands of GDSSs to cope with textual information. The helpfulness of visual representations of problems, such as decision trees, creates further demands, for which computer-based GDSSs may be designed.

Watson, DeSanctis and Poole built on the work of Huber and others in their experimental research, in analysing the impact of GDSSs on group consensus building (Watson et al., 1988). They found that consensus improved with use of either computer or manual support systems, when results varied significantly from those of a control group with no GDSS. They measured pre and post meeting consensus, for groups with one of three levels of support (computer based GDSS, a paper and pencil equivalent, or no support system) so that they could analyse the effect of levels of support on post meeting consensus.

The problem with this type of research is how to control for (or keep constant) other possible variables, thereby ruling out alternative explanations for variations in consensus. For example, the difference between pre and post meeting consensus could be down to the dominance of one group member in the discussion and influence over the process, causing other members to change their views.

Whilst their experiment involved 82 small groups of students, they made the point that “many of the students were employed full-time in business settings, and most were working at least part-time” (Watson et al., 1988, p467), so had sufficient business experience to bring some reality to the exercise. They assessed participants’ reflections on the problem solving exercise by using a post meeting questionnaire, and carried out mainly quantitative, but some qualitative analysis.

They found that use of the GDSS ‘tended to reduce face-to-face interpersonal communication’, presented the group with more of a challenge in managing the meeting, and led to a more procedure-oriented discussion, but contributed positively to post meeting consensus.

There is still some variation in opinion on the value of consensus building as an approach to decision making. Eisenhardt gave an example of one corporate executive’s opinion “We found that operating by consensus essentially gave everyone veto power..... Nothing ever got accomplished” (Eisenhardt, 1989, p563). It was unclear exactly what that particular company Vice President understood by ‘operating by consensus’, and what other possible causes for the fact that in his view ‘nothing got accomplished’ might there have been? Eisenhardt found that conflict resolution was more problematic in teams who worked more slowly, and that both the degree of consensus and the quality of decisions were better where the speed of decision making was greater.

John Adair presents a more positive view of consensus in his book on management decision making, which explores styles of thinking and problem solving (Adair, 1985). He makes the point, like Hall, that complete

unanimity is not a feasible objective in group decision making, but that consensus does not mean the same as unanimity. Adair defines consensus as:

"When the feasible courses of action have been debated thoroughly by the group and everyone is prepared to accept that in the circumstances one particular solution is the best way forward, even though it might not be *every* person's preferred solution." (Adair, 1985, p157)

This indicates that members of the management team have accepted that a particular course of action be chosen as the best, in the circumstances. The 'circumstances' would include explicitly their evaluation of the feasible alternatives, and implicitly their own goals or criteria upon which the alternatives were evaluated. It could be argued that consensus seeking approaches used in group decision processes may give rise to better goal congruence than alternative approaches (see Moscovici and Doise, 1994 for a full account of the arguments).

To summarise this section as a framework of analysis for reviewing field-based studies, the key elements of decisions which involve managerial judgement are:

- a) Heuristics (Tversky and Kahneman, 1974)
- b) Framing of decisions (Tversky and Kahneman, 1986, Hodgkinson et al., 1999)
- c) Information processing (Kahneman and Tversky, 1979, Holloman, 1992)
- d) Group approaches and consensus (Hall, 1971, Huber, 1984, Watson et al., 1988)

### **Field-based studies of SIDs**

A UK study undertaken by Butler, Davies, Pike and Sharpe (Butler et al., 1993) investigated SIDs in twelve companies (5 large, 5 medium and 2 small). Data were collected by structured interviews with fifty five informants, covering seventeen real investment decisions, and from an investment experiment based on eight synthetic proposals. The data were coded and analysed using regression and factor analysis.

In many ways the main study was really only one step away from the survey based studies reviewed in the previous section, but the framework was more flexible and the research resulted in a new model of decision effectiveness. The factors which were found to have a high degree of influence on decisions in both real and synthetic decisions were (Butler et al., 1993, p70):

- 1st Degree of corporate/strategic fit
- 2nd IRR
- 3rd Payback period
- 4th Impact of project failure (worst case scenario)

In the experiment the only other piece of information i.e. ranked fifth, was the best case scenario, whereas information available in real decisions went far beyond these five items. Other factors (of the 16 identified as possible explanatory variables) with a high degree of influence on the real decisions were focused upon *effects*:

- \* Effect on product quality
- \* Level of agreement/opposition
- \* Effect on productivity
- \* Growth rate of related market

Butler et. al. suggested weightings based on the cases they studied. Their research showed the extent to which judgement influenced SIDs as 34% (Butler et al., 1993, p187). However, having identified the importance of human judgement in their sample of SIDs, they did not attempt to link their observations to the relevant behavioural theory.

Carr and Tomkins' study examined the importance of cost management in SIDs (Carr and Tomkins, 1996). They used John Shank's framework for strategic cost management in technology investments (Shank, 1996) to analyse fifty one cases in UK, US, and German companies. They found that successful companies placed

five times as much attention on competitive advantage in SIDs, three times as much on value chain considerations, and twice as much on cost drivers, and less on capital budgeting techniques than the others. To the extent that competitive advantage, value chain relations and cost assumptions are likely to feature on any list of risk causes, this places risk assessment at a higher level of importance than DCF analysis.

The organisations were all in the motor components industry, where they found a 54% usage of DCF techniques (compared with Pike's 84% from his 1986 survey). The study suggested that non-financial, especially strategic and customer-focused considerations were more important than sophisticated computations. The managers placed more value on good industry knowledge than on formal analytical techniques.

Morone and Paulson (1991) studied four case companies in each of four industrial sectors, focusing on issues about the cost of capital and whether high hurdle rates were limiting competitive opportunities. They interviewed CEOs in companies related to technology and engineering, e.g. Texas Instruments and Intel Corporation.

Key questions in the study included:

- \* Is the cost of capital an important source of competitive advantage ?
- \* If yes, how is the problem managed ?
- \* What accounts for differences in views on the cost of capital ?

The results showed that of fifteen usable responses, five replied yes to first question, where DCF analysis influenced SIDs, eight answered no, where strategic analysis had priority over DCF analysis, and two held mixed views. The conclusion drawn was that the cost of capital was only important where DCF outweighed strategic analysis in decision making. This may have been quite counter-intuitive, at a time when interest rates and corporate hurdle rates in the US were considered to be high. They did not appear to expect to find so many companies giving more priority to strategic rather than financial analysis.

A single case study undertaken in a US company, Fuqua Industries, which also focused upon the cost of capital issue (Gup and Norwood, 1982) showed how a differential hurdle rate was calculated for each division. Gup and Norwood introduce their paper by stating that at the time of their study, approximately half of US firms surveyed were using a single hurdle rate (Brigham, 1975), but the academic debate on the use of a single or a differential rate continued.

Their argument for the use of differential rates was based on the diversity of business activities across the divisions, and the logic in treating each division as if it were a separate company. For an organisation with twenty two divisions, Fuqua found this argument persuasive enough to devote a development project to identify a risk adjusted cost of capital for each business segment.

The model which emerged was an extension of CAPM theory, with an adjustment for each division based on an objective and *subjective* risk index. It is the nature of the subjective risk index which is of interest here. The subjective risk measure was based on a divisional risk profile incorporating an assessment of fourteen 'risk elements', which are described as "factors that management considers important for evaluating each division" (Gup and Norwood, 1982, p22).

Weaknesses in the paper are that 'management' is not defined, and how the data was collected and analysed is unclear. This is a fundamental flaw in a model based on judgement, to not make explicit whose judgement or how it was sought. However, the fourteen factors seem reasonable, intuitive and flexible enough for diverse business units.

Each division is given a score of 1 to 5 on a risk scale for each element (unless not applicable at all), and the score is totalled and divided by the number of applicable elements to obtain a simple average score. This score is then averaged with the objective risk score to get a combined risk classification, which is converted

to a risk index, with a midpoint of 1.05. The range of values in this index was derived by analysing the beta values of firms competing with Fuqua divisions, adjusted for gearing, relative to Fuqua's beta. It is then used as a multiplier to expand or shrink the corporate cost of capital based on the CAPM.

The use of 1.05 as the midpoint in the conversion, equated to a score of 3 on the five point scale, has the effect of adding a 'comfort factor' of 5% to the index, which is not even discussed in the paper. The use of a simple average both to combine the objective and subjective scores, and to combine the fourteen risk elements ignores the possibility that some factors may be more important than others.

It also assumes that all projects appraised within the division will share the risk characteristics of the division, which is not necessarily so, or it ignores any project variation. Overall there are significant flaws in the paper, which make its contribution to knowledge in this area very limited. However, each single company case study adds something to what we know of practice. In this case the risk elements thought to be worth measuring.

A UK study which looked at investment appraisal in six hotel companies of different sizes, found a diverse range of practices within a single homogeneous sector (Collier and Gregory, 1995). The homogeneity came from the type of decisions commonly made, and the standard use of performance measures such as occupancy rates and average room rates, and building costs per room.

It was suggested that since decisions were rarely complex and that information was easily sourced, sophisticated risk analysis tools were not needed. The diversity of practice found related to the way in which the discount rate was determined. Two companies used the borrowing rate plus basis points or a percentage, one (a division of a larger company) used the group weighted average cost of capital, and one "may have made use of the CAPM" (Collier and Gregory, 1995, p55). This wording of the finding leaves an element of unexplained ambiguity. The other two had no use for a discount rate as DCF analysis was not employed (one preferring the payback method, and the other making only limited use of financial analysis, preferring strategic and market analysis).

None of the companies used formal risk analysis techniques, but the four using DCF analysis also used a form of sensitivity analysis. One unifying feature of the cases studied was the use of management experience of the hotels sector in making judgements on projects. This emphasis on industry knowledge and context specific rules of thumb mirrors the findings of Carr and Tomkins in the motor components industry.

This idea that the theoretical approaches to capital budgeting, and particularly the use of formal risk analysis techniques, were not driving decisions in practice prompted Smith and Murray to explore informal approaches, they called 'coping mechanisms', being used by UK managers (Smith and Murray, 1997). Their study gave an in depth analysis of practice in six case companies in the East Midlands. Unlike Collier and Gregory, they selected companies from across a range of business activities. They identified four 'coping mechanisms' from the literature initially, for example (Carr et al., 1994; Collier and Gregory, 1995; Drury et al., 1993; Jones and Dugdale, 1994; Marsh et al., 1988):

- \* Adjustments (to inputs, producing extra conservative cash flow forecasts)
- \* Experience (to question unrealistic assumptions, using rules of thumb)
- \* Checking (by cross-examination of proposers and their assumptions)
- \* Sharing (team-based discussions around problems or specialist inputs)

Further into the study, a fifth mechanism, 'Political behaviour' was added (Bower, 1986), where soundings might be taken in advance of important meetings and decisions. This was found to be particularly relevant to four of the six companies which were divisionalised. After analysing the environment, processes and attitudes to risk in all six companies, evidence led the researchers to add a sixth mechanism which they called 'strategic context', which essentially meant that strategic analysis was being used in practice as a proxy for or as part of risk analysis. It was not clear how 'strategic' the decisions analysed in this study were. Limited use of formal quantitative risk analysis techniques was found. Both of these findings were

consistent with Collier and Gregory's. Even in the company where simulation was used to model the production process, it was not used in relation to cash flow forecasts.

In two companies, subsidiaries were expected to assess risk subjectively, by categorising project risk as low, medium or high, but without any guidance as to how the judgement should be made. Rationales were obtained for an illustrative project which had been assessed as low risk. The reasons given were that raw materials prices and labour costs were 'easy to predict' and prices were 'fairly stable'.

So the risk assessment seemed to be based on the level of confidence the proposers had in their estimates. In the other four cases there was no company policy on risk assessment. Two of those were not required to assess risk at all, one was required to identify 'all non-monetary facts' and the other was required to give 'narrative about variables'. Four of the six companies used a capital appraisal manual, but only one company had provided risk training.

Lack of training or awareness of risk analysis techniques was one of the reasons given by over half the respondents for lack of use of formal techniques. Another problem respondents had in applying techniques was linked to the information requirements to input to a quantitative method. The information causing problems was often market information, sometimes technical information, and usually information on the wider business environment.

These concerns went some way to explaining why informal techniques dominated decision making in the six cases. However, this study did not explore the information processing aspect further. Smith and Murray made a link with behavioural decision research, albeit rather tenuously. Their 'coping mechanisms' suggested ways in which judgement is exercised in dealing with risk in decisions, offering an insight into the information environments that existed in their cases. The study added some further evidence to support earlier work by Bower (Bower, 1986), concluding that managers do not analyse risk formally, but have developed coping strategies, including the learned pessimism and rules of thumb of their industry.

The findings may have been linked to earlier work in this area (for example Libby, 1981, or Hirst and Baxter, 1993). Hirst and Baxter sought to investigate the descriptive validity of theoretical models of choice and the role of information in the choice process (Hirst and Baxter, 1993). They identified four models of choice and three roles of information, but were unable to find a close enough fit to any one model or role when they analysed a single decision in a single case study, having carried out a detailed investigation.

A recent study which explored investment in R & D projects, and particularly the risk assessment procedures (Nixon, 1995), clearly links the adoption of sophisticated risk analysis techniques (as defined by Pike, 1988) with the nature of the decision. All six companies reported on (out of thirteen investigated) made some use of probabilistic methods, and three used no less than ten techniques, including simulations, linear programming, and probability analysis, as well as sensitivity and scenario analysis and critical path analysis. In addition to the internal risk analysis techniques applied, two of the three UK companies in the study and to a greater extent the three US companies developed risk assessments in collaboration with external parties.

Most significantly, co-development of risk assessments with customers and suppliers (existing and/or potential) and research organisations was part of at least four companies' procedures, and sometimes with financiers. Again this indicates a strategic and customer focused approach to the consideration of risk (Carr and Tomkins, 1996; Collier and Gregory, 1995). The risks which were seen as the greatest threat to successful innovation for investments examined in Nixon's UK companies were:

- \* Management capability
- \* Market/commercial risks
- \* Financial risks

Of these three types of risk, the first two are concerned far more with *cause* than *effect*.

Another case based study which investigated the role of information in strategic decisions found that fast decision makers use more rather than less information than slow decision makers (Eisenhardt, 1989). This seemed counter-intuitive, but accelerated cognitive processing using efficient problem-solving strategies and maximum information available (within time constraints) led to fast decisions being made without loss of performance. The study was undertaken in the context of the microcomputer industry, described as a 'high-velocity environment', which seemed to have influenced the firms to develop more advanced information systems to support managerial decision making.

The sheer volume of decisions that these executives were faced with allowed them to learn from feedback from past decisions more quickly, and increased their confidence to make fast decisions in the future. One might argue that this strengthened their ability to use Holloman's 'head and heart' domain, as they were able to benefit from more experience in a shorter amount of time and sharpen their intuitive capabilities.

During the 1990s there has been a "burgeoning interest in intuition as a basis for decision making and problem solving in organizations" (Allinson and Hayes, 1996, p119). This is defended, but at the same time acknowledged as 'fashionable' by Hunt (1998), who makes the point that intuition or insight is difficult for people to describe to others. This, in turn, raises the issue about how individual managers might share their intuition or insights with others in group-based decision making.

Harris (1999) sought to draw upon the insights of managers by capturing the risk constructs of divisional board members in a large European group of companies, using a repertory grid technique. Once a set of attributes had been agreed by participants as a language by which they shared an understanding of the comparative riskiness of their projects, it was used as a framework for assessing the level of risk attached to SIDs each time a new proposal was generated.

The project risk attributes found in this study (based on personal construct theory) were compared to the 'risk drivers' described by Chapman and Ward (1997), and showed a high degree of similarity. Having discovered how managers in her case organisation construed project risk (in terms of cause rather than effect), Harris went on to develop a risk assessment technique for use in SIDs, thus operationalising the managers' own risk measures. In developing new management techniques for dealing with risk, it is argued that the identification of causal factors serves more purpose. Managers can take mitigating action so much sooner at the cause stage than if they must wait for variations in outcomes (effect) to be manifest.

One of the twelve causes of risk in SIDs resulting from the action research undertaken by Harris was 'strategic fit'. The perception of strategic fit as a project risk driver sits well within a management control theory of capital budgeting (Emmanuel, Otley and Merchant 1997), as any capital investment project which does not contribute to the achievement of strategic goals would be deemed to be out of control. Whilst it is not always thought of as a risk driver, strategic fit is given a high priority in other field based studies in SIDs (Butler et al., 1993; Grundy and Johnson, 1993; Morone and Paulson, 1991).

### **Revisiting the SID process**

Three industry specific studies (Collier and Gregory, 1995, Carr and Tomkins, 1996, and Harris, 1999) found that good industry knowledge was highly valued as a basis for managerial intuition, and provide evidence to support the use of *representativeness*, *availability* and *anchoring and adjustment* heuristics suggested by Tversky and Kahneman (1974). Smith and Murray (1997) also found managers operationalising heuristics in order to reduce the complexity and develop manageable coping mechanisms. Personal construct theory (Kelly, 1955) applied by Harris (1999) has a number of corollaries which fit with Tversky and Kahneman's theory on heuristics.

Butler et al. (1993) and Smith and Murray (1997) both support the importance of the framing of decisions in terms of how project opportunities are described and presented, which analytical techniques are adopted and which factors have most influence on managerial judgement.

Nixon (1995) and Harris (1999) linked the framing of decisions with the nature or type of decision being made, and the risk analysis techniques adopted.

Several studies discovered the mix of intuitive and analytical information (Holloman's heart and head) and the importance of the information environment (Eisenhardt, 1989; Grundy and Johnson, 1993; Gup and Norwood, 1982; Hirst and Baxter, 1993; Morone and Paulson, 1991) in support of prospect theory.

The political processes identified by Bower, from his case analysis, whereby projects are sponsored up through the organisational hierarchy, having been chosen at an early stage, seem just as relevant today. Smith and Murray (1997) found evidence of aspects of group behaviour, such as checking and sharing of information, Nixon (1995) found evidence of companies sharing information for risk assessment with external parties such as customers and suppliers, and Harris (1999) described a process of managers sharing information within a multi-functional team.

Evidence from the study by Harris (1999) supports the description of practice put forward by Bower in 1971 (Bower, 1986) in terms of when, where and by whom decisions are actually made (figure 1). Strategic options are often formulated within divisions and effectively screened at an early stage by managers at lower levels in large organisations, such that decisions are virtually taken well before the full DCF analysis and sensitivity analysis is presented at group board level.

It is argued here that this practice based approach to the development of an integrated theory of SIDs is more pervasive than the normative economic theories developed hitherto. The challenge is for researchers to work across discipline boundaries in developing theories and techniques which managers will use because they believe in them. Otherwise, organisations may adopt practices simply because society expects them to, or the accountants have only been trained in certain techniques such as DCF (Tyrall, 1998).

## **Conclusions**

The conclusion reached here is that when one takes a broader view of risk, as *cause* rather than *effect*, it involves a level of complexity which no single theory can cater for. There are many theories, especially from the behavioural literature, which are relevant to risk in SIDs, but each gives only a partial explanation. By taking an eclectic approach to theory, many common themes may be found, but the proposition of the existence of a theory practice gap becomes overtaken by conflicting theories, resulting in more of a theory theory gap.

Managerial assessment of risk in SIDs is important, in that it occurs implicitly, and influences judgement. It is, however, bound up in the context of personal constructs and the shared values and beliefs of organisational culture. This means that elicitation has to take place in the field, and that there can be no 'one size fits all' solution.

Further research is therefore required to close the theory theory gaps, and to move the practice of risk assessment in SIDs forward. Future research could usefully explore risk assessment in different business sectors, with different types of project. Aspects which would benefit from attention would be group SID processes and the role of consensus, and the link between SIDs and management reward schemes.

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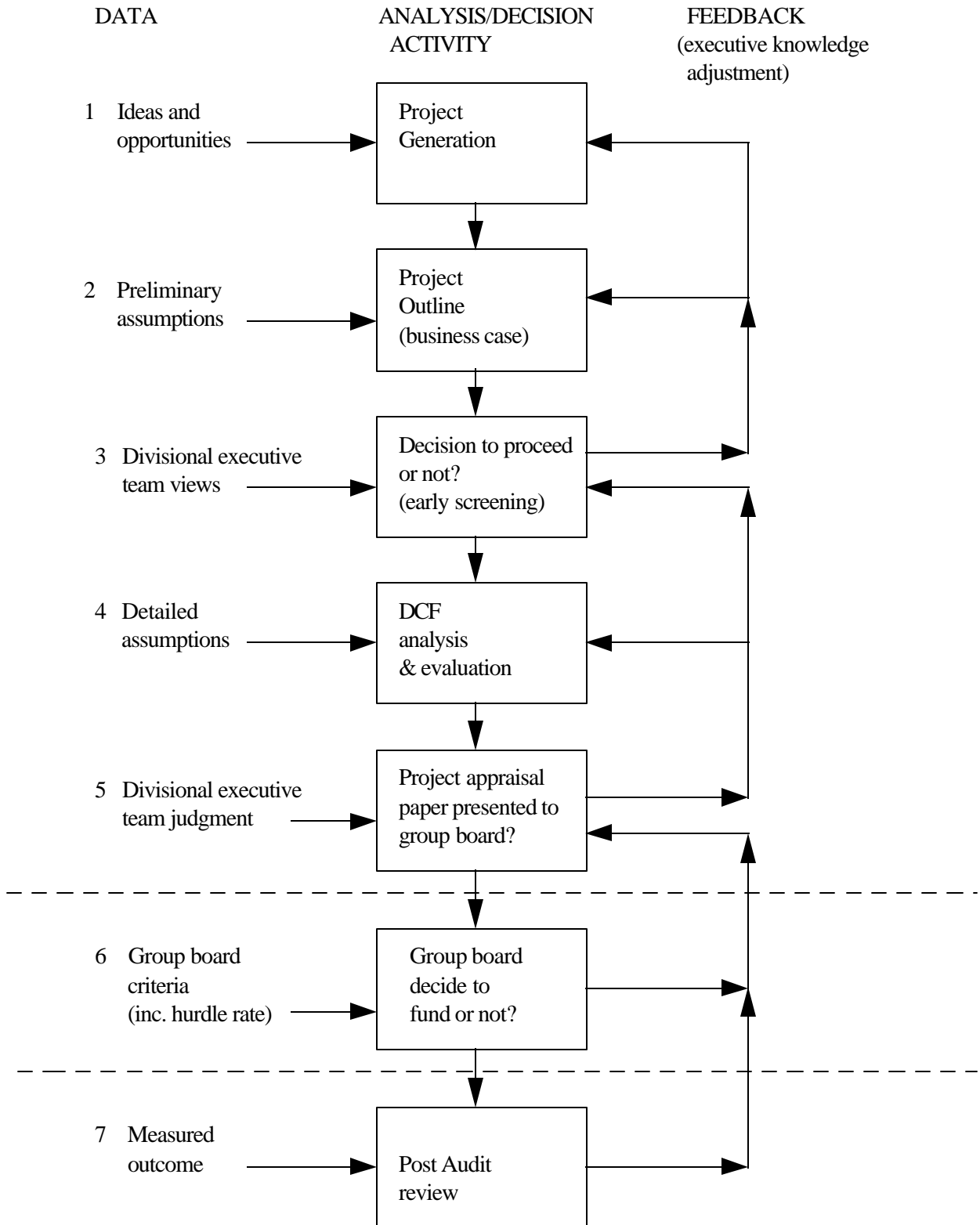
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Figure 1 Strategic Investment Appraisal Process



Source: Harris (1999)

