4 Strategy Alternatives

CHAPTER CONTENTS

INTRODUCTION

Management decision-making is often constrained by inhibited thought processes and a blinkered approach. Frequently this will result in sub-optimal choices because too few feasible alternatives have been generated, making the selection procedure fatally flawed. Management accountants are often guilty in this respect because they have not been trained to think creatively and have not been equipped with management tools to aid innovative thinking. Creativity in accounting is not necessarily an impediment if it encourages a move towards non-traditional approaches to problem-solving.

One of the greatest potential benefits of the adoption of a new corporate culture – for example, a commitment to total quality management, value-added management, or theory of constraints – is a renewed emphasis on creativity in the workforce. Such benefits should accrue to the management accounting team where, as elsewhere, a creative approach is often constrained by the predominance of traditional reporting mechanisms.

When solving problems, making decisions and choosing between alternative courses of action, we need to determine the optimum solution, rather than falling back on the prevalent attitude that close enough is good enough. But our selection can only be as good as the alternatives from which our choice is made. More attention needs to be devoted to the generation of ideas and alternatives if the search for an optimum solution is not to be inescapably constrained.

Training will underlie any attempt at effecting a change in attitudes. Management accountants are too rarely taught to think, and too rarely equipped with the management tools which facilitate the process. Indeed, the word 'creativity' itself – most usually encountered in the context of 'creative accounting' – immediately conjures up images of fudging, of blurred edges, economy with the truth, and even fraud. Such negative perceptions must be overcome, or at least softened, if a less blinkered approach is to be encouraged. Psychologists have identified a number of thinking aids as tools to facilitate creativity. They include brainstorming,

lateral thinking, synectics, affinity diagrams and force fields techniques whose application to the management environment is well established. As practising accountants we are prone to be too backward in embracing the ideas of other disciplines and incorporating them to advantage in our own processes, though such practices are well established and accepted in accounting research (see Smith, 2003: 1).

We should aim to avoid jumping to conclusions and offering quick-fix solutions without sufficient emphasis on the options and the consequences of our actions. Problems rarely exist in isolation, and the chain of dependent events must be examined in each case. Understanding the root problem, not merely its symptoms, is often the greatest challenge, requiring clarity of thought and the avoidance of obscurity. It is thus fruitless to identify a problem as 'communication difficulties' or 'low morale'; if a solution is to be discovered then it is essential to frame the problem much more specifically than this. We should approach each issue in well-defined, bite-sized chunks. A team approach is very much to be preferred in the generation and evaluation of ideas. A structured, group decision-making process for assigning priorities and reaching consensus provides an environment conducive to the development of creative solutions.

CREATIVE THINKING

Delbecq and Van de Ven's (1971) nominal group technique is one such systematic approach. The technique embraces a number of key stages:

- Team members' suggestions for improvements are collected without discussion, criticism or evaluation, in order to encourage contributions.
- Team ideas are aggregated prior to evaluation and the identification of trends and patterns.
- A group process is initiated for the ranking of ideas for importance and the selection of key opportunities for further analysis. This voting system helps to eliminate 'pet' ideas with scant group support and to alleviate the effects of status differences between team members.
- Selected ideas are assigned to teams for further investigation so that recommendations and preliminary action plans can be developed.

The success of the technique will usually depend on the combined strength of the team members, their commitment to the process and their training in the appropriate management tools. It may be a frustrating exercise initially, since many contributors will see the solution as 'obvious' from the outset. If they recognize the acceptability of alternatives as a result of the creative processes then this revelation will have made the process worthwhile.

Consider the familiar portrait of the wife and mother-in-law in Figure 4.1. This ambiguous picture was originally drawn by W.E. Hill and appeared in the 6 November 1915 issue of *Puck*. It was subsequently employed in psychological research by Boring (1930). The picture may be perceived differently by individuals because of the way they relate the figure to its background. Some observers see only the old woman, with hooked nose, jutting chin, slit mouth and headscarf. Others see only the profile of the young woman,

FIGURE 4.1

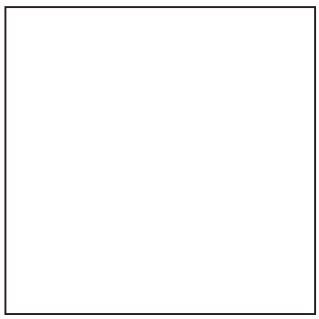
Female perception alternatives

with pert nose, mascaraed lashes and plumed headwear. Many observers still fail to see both figures even when they are aware that the portrait contains two likenesses. Their search for alternatives has ceased because they have found one acceptable interpretation of the figure – they fail to go on to consider the existence of alternative interpretations.

In a management accounting context, we wish to avoid focusing inappropriately on the obvious, so providing an opportunity for generating acceptable alternatives. This means searching for more, potentially better, strategies; we wish to create a management environment where we do not stop looking for better solutions because we have already found a satisfactory one.

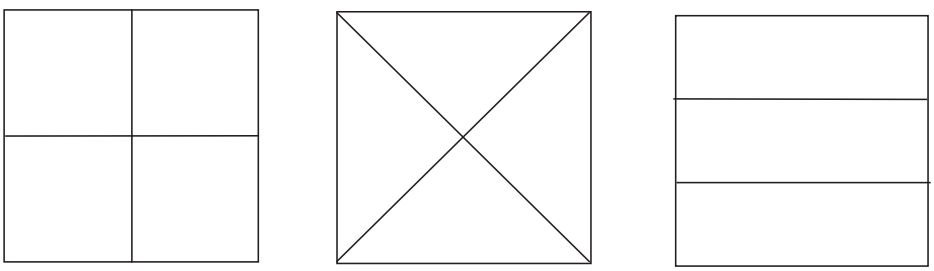
Consider the problem in Figure 4.2 suggested by Edward de Bono (1970). Most people can generate three alternatives very easily, but tend to grind to a halt once they have reached the stage illustrated in Figure 4.3. Further progress requires a change in attitudes and a questioning of the fundamental assumptions we are working with. What is a continuous line? Does it have to be straight? Can it be stepped? Appropriate answers to this last question frequently generate the alternatives shown in Figure 4.4. This is the critical step. Once taken, it becomes apparent that there are many alternative kinds of lines which will provide acceptable solutions. Once the lines become curved, as in Figure 4.5, we realize that an infinite number of potential solutions might be generated through infinitesimal variations in the curvature.

FIGURE 4.2



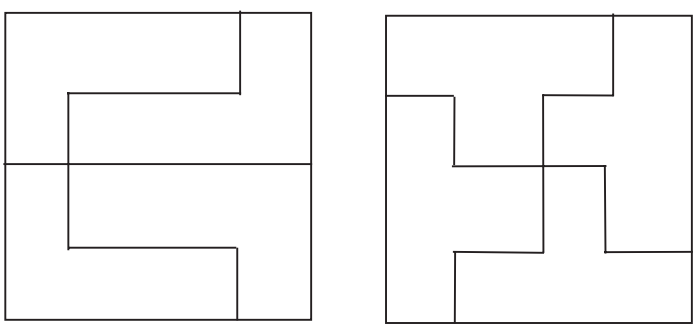
The de Bono problem: use two continuous lines to cut this square into areas which are equal in size and shape

FIGURE 4.3



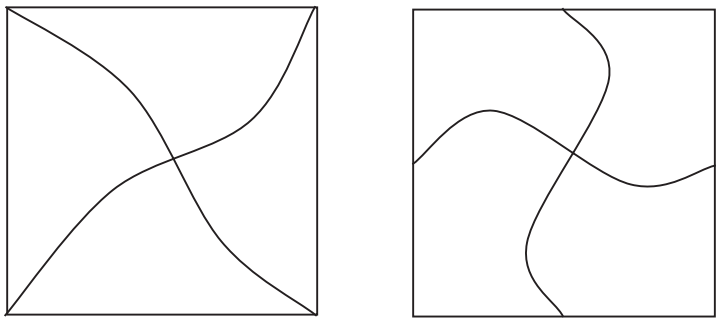
Simple solutions to the de Bono problem

FIGURE 4.4



Stepped solutions to the de Bono problem

FIGURE 4.5



Curved solutions to the de Bono problem

The requirements for problem-solving in a management accounting environment are clear:

- a precise definition of the problem, with an awareness of inhibiting constraints;
- a willingness to accept the existence of alternatives; and
- the avoidance of a closed-minded attitude which focuses on a single, obvious solution.

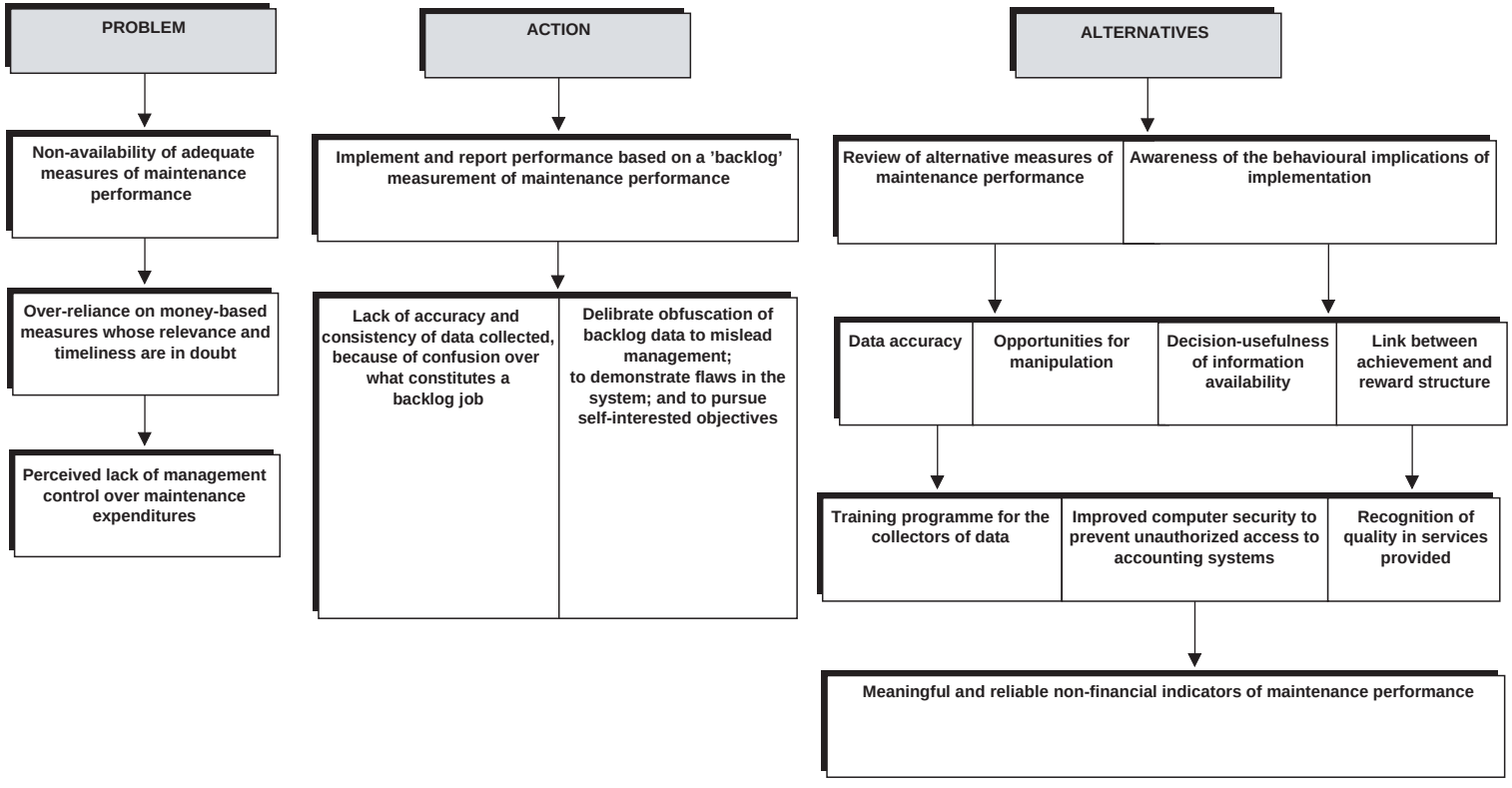
Figure 4.6 provides an example of a flawed decision-making process. Adapted from an actual instance of management reporting in an Australian manufacturing company, it illustrates the consequences of responding inappropriately to a problem rather than examining the root causes of potential difficulties. By rushing into a quick-fix solution, time and money are needlessly expended in producing an outcome which offers no improvement on the original! More considered thought and wide-ranging problem analysis prior to implementation ensures that we are aware of the likely consequences of actions and the eventual outcomes that are desirable.

The messages of creativity, innovation and lateral thinking are thus not confined to problem-solving and decision-making, but can be extended to the management processes and the reporting environment.

DEVELOPING AN INNOVATION CULTURE

Long-term improvements in economic performance demand that firms develop an adaptive culture in which innovation features prominently. To nurture an innovative and flexible workforce which facilitates product and process changes, an environment must be created which eliminates cautious and protective attitudes and encourages risk-taking. The harnessing of the creativity of the workforce in order to promote innovation remains problematic in most companies. We know that innovation is good for us, but how do we achieve it? What systems and work environment need to be in place to encourage innovation? How do we change the culture of the

FIGURE 4.6



The need for alternative strategies

organization to make innovation a central part of it? All fundamental questions, to which the academic literature and the experience of practitioners can provide guidance, if not a complete solution.

For example, Collins and Porras (1994) observe that long-lived companies, with financial performance which has established them as industry leaders, often share a number of common qualities:

- core values, which dictate the behaviour and recruitment of employees;
- alternative goals to that of 'making money';
- a focus on continuous self-improvement, rather than just beating the competition;
- recognition of the importance of trial and error, and learning from failures.

A culture which embraces learning from mistakes, rather than inculcating a 'get-it-right-the-first-time' mentality, therefore provides a link with longevity, linking the latter with an innovation culture.

Kotter and Heskett (1992) detail a relationship between organizational culture and profitability, in which long-term financial success was associated with:

- visionary leadership, clearly articulating future directions;
- walking the talk, so that there is no conflict between words and action;
- attentiveness to the needs of all stakeholders;
- empowerment of employees, and
- dedication to continuous improvement.

Common characteristics emerge in commitment from the top, team working and the encouragement of creativity, which are all factors in the creation of an innovation culture.

Inventions will not just emerge; conditions must be established to encourage their emergence. For our particular organization we should be aware of where the ideas for innovations will come from so that they can be sourced properly. Ideas will usually be generated internally (from the workforce) or externally (from customers or suppliers) but inter-industry differences are inevitable.

There is some evidence to suggest that the 'type' of innovation will be important in determining its likely source. Thus we have the matrix of Figure 4.7 to dictate the likely source of 'product' or 'process' innovations.

We also have to decide how we intend to generate ideas:

- Are they to be problem-specific?
- Are they to be random? In which case we seek lots of good ideas in the knowledge that relatively few will actually be implemented.

The reactions of those generating the ideas are paramount in deciding which approach to adopt:

- If we encourage the generation of ideas, then sit on them without taking any action, we will not get ideas generated in the future.
- If we reject some ideas out of hand without providing an adequate justification, we will lose the goodwill and creativity of these individuals. De Bono (1992) presents an interesting alternative to the simple accept/reject decision, in which ideas are graded as directly usable, good

FIGURE 4.7

SOURCE / IDEA		External	
	Internal	Customer	Supplier
Product	✓	✓	
Process	✓		✓

Source of innovations

but not for us, good but not for now, needing more work, powerful but not usable, interesting but unusable, of weak value, or unworkable.

- If ideas are rejected publicly, trivially or jokingly, so that participants lose face as a result, we will alienate a whole segment of potential creativity.
- If ideas are converted into successfully implemented innovations without the innovator being adequately rewarded, then this too might stifle the future flow of ideas. We have to counter the 'why should I bother?' mentality. Precisely what form this reward should take causes a good deal of controversy. Much of the US literature suggests the use of plaques, blazers and ties rather than monetary rewards. Experience elsewhere suggests that it is dollars that counts – and big dollars for innovations that generate million-dollar savings.

Sourcing ideas outside the organization demands closer ties with external organizations:

- Suppliers might be interested in innovation-sharing, so that technological ingenuity is not confined to one company.
- Subsidiaries may prefer to pay royalties to the parent company to share in the benefits of innovations; though the implications may be that individuals feel that the 'pressure is off' and innovation is no longer part of their job.
- For the solution to specific technological problems, outside scientific agencies might be sourced to provide alternatives at a fraction of the cost charged by consultants.
- Close links with local universities might be developed to provide a 'think tank' atmosphere for creative solutions.
- Customer surveys and marketing research should be used to identify unsatisfied needs and potential innovative opportunities.

Many organizations have the perception that the customer often does not know what they want until they see a new development in the marketplace. There is plenty of anecdotal evidence to suggest that there is some truth in this, which makes it important for organizations to have effective screening systems in place to deal with the multiplicity of ideas

under consideration. Figure 4.8 provides a representation of the innovation process, showing the importance of the 'sourcing' and 'screening' activities.

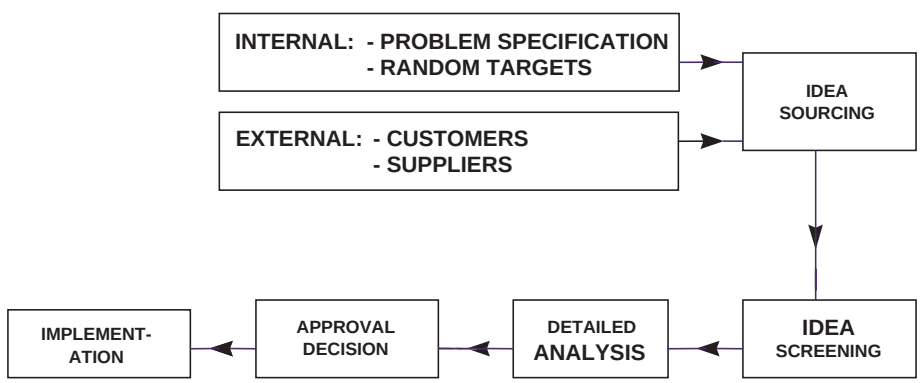
Market-based evidence suggests that as many as 40% of new products launched fail in the marketplace, and that 46% of the industry resources devoted to new products are spent on failed or cancelled projects. Management needs to be able to spot probable new product winners early, and to allocate development resources to these projects. This makes the 'screening' stage of the innovation process so vitally important. Most projects will be killed off at the 'screening' stage for new products, but two errors will be made:

- some 'losers' may creep through the process, and
- some viable projects which are just too innovative may be rejected by too rigid a screening mechanism.

We need to weigh the cost of lost opportunities against the cost of misallocated resources, and balance rejection and acceptance errors. However, the screening decision remains an investment appraisal under extreme uncertainty and with no accurate financials until the end of the product development or, indeed, commercialization. A further problem is illustrated by the dilemma of what precisely constitutes a 'good' innovation. If what has been judged as a 'good idea' is subsequently a commercial failure because of marketing and implementation errors, does that, in hindsight, make it a 'bad idea'? Similarly, if an idea viewed subjectively to be 'poor' is successful because it hangs onto the coat tails of a new market craze, does that suddenly make it a good idea? Some judges would make commercial success the only criterion for a 'good idea', but we have to have alternative judgement criteria in order to clear the previous hurdle, that is, to decide whether or not to bring the idea to market.

The most popular screening methods involve the rating of product attributes, and the subjective assessment of the project to give a numerical project score. It is usually assumed that the success of a project can be predicted from an examination of the product profile and that future successes/

FIGURE 4.8



The innovation process

failures will have similar product profiles to previous successes/failures. This form of 'failure' modelling is therefore very similar to that for bankruptcy prediction (see Chapter 9) whereby appropriately weighted financial factors for current companies are compared with the corresponding financial profiles of known previous failures.

To identify successful future products, R.G. Cooper (1985) suggests that there are four key factors:

- market – size, growth and level of competition;
- product advantages – uniqueness and superiority;
- project–company fit – in terms of technology and distribution networks;
- size and complexity of the project – relative to the firm's readiness to innovate.

In each of these areas, Cooper identifies the characteristics sought in order to promote successful adoption and implementation of innovations. The *market* should be large, have high growth and exhibit high need, low competitive intensity with few competitors, few new products and little price competition. The *product* should be of higher quality, have greater reliability, encourage new customer behaviour, be highly innovative, and first to market. The *project–company fit* analysis will hopefully point to synergies in market research, managerial skills, sales and distribution, advertising and promotion, technology, and research and development. Finally, the *firm readiness analysis* may reveal disadvantages associated with diversification, particularly those associated with moving to a new product class with new types of user and new competitors, new processes and new technology. Cooper claims a high success rate for his commercial project, NewProd, which incorporates the above factors, appropriately measured, into a model to predict the success of product innovations.

What is apparent from the innovation process is that we need to recognize industry differences, and to have a system in place which is capable of both generating and screening ideas. Both require the development of an innovation culture within the organization. The firm's readiness and flexibility to innovate will be influenced by accounting factors relating to both strategic direction and management controls. Within a management accounting context, Askarany and Smith (2004) have shown that the work of Rogers (1995), in the management field, can be extended to demonstrate those important characteristics of accounting innovations which are associated with implementation and adoption.

A number of authors (notably Miles and Snow, 1978; Porter, 1980; Miller and Friesen, 1982; Covin, 1991) have developed alternative typologies to characterize the organizational strategies that are associated with success. These are helpful in clarifying the attributes we would expect to find in innovative companies. Miles and Snow suggest prospector/defender categories, Porter differentiator/cost leader categories, and Miller and Friesen (amplified by Covin) entrepreneurial/conservative categories. Each of these groupings represent extremes in their attitude towards innovation. Combining the three research works allows us to consider the characteristics of two distinct types:

- Prospector–differentiator–entrepreneur: emphasize innovative aspects of firm activity; minimize customer sensitivity to price; offer products unique in design and brand image.
- Defender–cost leader–conservative: emphasize stability; promote cost leadership through controls; focus on asset use and employee productivity;

seek maintenance of current market niche through quality, superior service and/or lower prices.

The first of these strategy types (prospector–differentiator–entrepreneur) is the one we seek to promote in the pursuit of innovation, and which generates congruent strategies:

- aim to be first to the market, rather than being content with being 'good at what we do now';
- change products and services frequently and implement active search processes;
- respond flexibly to market opportunities;
- promote a team-based empowered approach to new product development;
- reduce delays by delegating responsibilities; avoid hierarchical bureaucracies and the rigidity of long chains of command;
- emphasize new product and production technologies, rather than efficient mass production.

When considering the role of organizational control in innovation Waldersee and Sheather (1996) emphasize the incompatibility of an innovative and flexible workforce with the rules, procedures and top-down management which typify a conservative strategy. Where managers are forced to focus on efficiency and cost control the benefits of participation and consensus may be less apparent.

Prospectors–differentiators–entrepreneurs actively pursue innovation; control systems might be used to warn against excessive innovation, especially if its long-term objectives threaten the short-term survival of the enterprise. Defenders–cost leaders–conservative types are likely to have detailed control systems focusing on problem-solving and reducing uncertainty, but providing little assistance in new product development or the need for innovation.

Smith (1997) suggests that the traditional sources of competitive advantage (detailed by Porter, 1985) – efficiency, productivity and throughput as a result of technological leadership and low cost per unit – may no longer be appropriate in an environment pursuing competitive advantage through innovation.

With the adoption of advanced manufacturing philosophies, the implications for control systems at all levels need to be addressed. It is quite conceivable that the administrative controls introduced to facilitate administrative change (e.g., activity-based costing) may be incompatible with the pursuit of innovation.

Rogers (1995) suggests that innovation may be thought of as progressing through four stages;

- adoption – where the need for change is recognized, but where a high level of uncertainty exists;
- preparation – the process of training, consulting and data collection;
- implementation – introducing and evaluating its impact;
- routinization – where innovation becomes a normal part of everyone's job.

As management accountants we need to review the control systems, performance measures and reward systems that we have in place, to ensure that this four-stage process can proceed efficiently and is consistent with the strategies outlined above in pursuit of innovation.

EVALUATION

The positive and negative aspects of all alternative strategies which generate desirable outcomes must be considered with respect to corporate priorities and the likely results of different courses of action. Evaluation may reveal evidence of potential conflict between corporate strategy and performance measurement. For example, we might anticipate that this would appear in:

- *Different time-horizon reference points*. While senior management might be pursuing medium and long-term objectives, the focus at lower levels will more likely be short term, or even, in a manufacturing environment, exclusively shift-based.
- *Different emphases attached to the importance of costs*. Where senior management might focus on cost control and adherence to budget, at lower levels cost considerations may be secondary, cursory or even non-existent as 'getting the job done' assumes priority.

The latter point is potentially damaging because it may lead to a lack of goal congruence, where the pursuit of individual target indicators (such as production volumes, or labour and equipment productivities) may not be consistent with strategic corporate goals.

In manufacturing industry, nowhere is the measurement issue more fraught with danger than in the maintenance function. Studies by the author in both the UK and Australia highlight a laudable degree of experimentation in attempts to measure quality of workmanship and standards of performance in the provision of a maintenance service. This provides an excellent example of the problems which the management accountant faces in formulating measures which inspire confidence in management without provoking a matching scepticism at leading-hand level and below regarding the accuracy of data inputs.

Job cards completed by operators or contractors may be notoriously inaccurate if they necessitate the recording of:

- job numbers or area categories – often involving six-figure costing codes consistent with cost information systems;
- hours on the job or time of completion;
- allocation of overtime hours between alternative jobs; and
- allocation of equipment time to alternative activities.

As well as inaccuracies due to accident, design or complacency, there exist opportunities for self-interested manipulation as illustrated in Figure 4.6. Such opportunities are manifestly apparent in measures of the backlog, either in time or the number of jobs – popular in the literature, but often eliminated as unworkable in practice. Three critical questions arise:

- What is a backlog item? Can it be dropped from the schedules with ease to reappear as forward scheduling or breakdown maintenance?
- Can jobs be closed early to reduce backlog – only to reappear as new jobs or reworks?
- Is it in the interest of the maintenance team to reduce backlog? In practice, it will only be in their interest if their reward structure is linked to the performance measure. If, as a result of their increased efficiency,

some men are redeployed or the supply of available overtime dries up, then the motivation to seek further improvements will be curtailed.

The human factor – both in terms of data accuracy and in the manipulation of data – is central to the successful measurement of outcomes and, therefore, an appropriate evaluation of alternatives. Any comparison of outcomes with expectations must be viewed systematically. It is pointless focusing only on apparently underperforming projects because this biases the review – there may be opportunities for improvement in strategies which are already performing to expectation.

The post-implementation review provides the opportunity for uncovering errors and bias, deliberate or otherwise, in the original objective statement. The negative aspects of the evaluation arise in terms of the possible witch-hunt when projected results have not been achieved, generating finger-pointing and the need to find someone to blame. This makes it difficult to rely on the effective co-operation of those involved, and may prevent a complete evaluation taking place.

This is a great pity and a lost opportunity for learning where errors are likely to occur and where bias can most easily be introduced. An unbiased evaluation of alternatives – including those not implemented – has potentially great benefits for the organization, but is dependent on more enlightened views of the nature of the investigative procedure.

Any appraisal of the quality of investment decisions should address the way in which the decisions have been taken as well as their consequences. This would include the following stages:

- Project generation: which projects are put forward for examination?
- Cash flows: how and by whom are these estimated?
- Analysis: what methods and assumptions are employed?
- Selection: importance of financials/non-financials in project choice.
- Authorization: documentation of monitoring process for project implementation.
- Evaluation: do the project outcomes match/exceed expectations?

A post-audit investigation can potentially have a significant impact on the manner in which future appraisals are conducted. Problems with implementing post-audit schemes range across the whole gamut of which? where? how? and by whom? Big companies may be able to audit internally, others may need to employ consultants. Either way, the continued co-operation of those individuals involved in implementing the project is essential. Any breach of confidence will reduce the levels of active co-operation and, potentially, destroy the learning opportunities. The post-audit could extend over:

- all projects currently underperforming;
- all projects implemented (underperforming or not);
- all projects considered (implemented or not); and
- a sample of any of the above.

In practice, post-audit evaluations appear to be conducted rarely, except for the very largest of projects. The reasons for not doing so usually range from 'Not enough time: too busy with appraising new projects' to 'What's the point? the money has been spent'. We might speculate that the real

reasons are more likely to do with the 'witch-hunt' that might arise if errors were to be found.

The following case is particularly rewarding because the post-audit was conducted by a group of master's degree students, three years after the investment had been implemented (to avoid sensitivity of individuals), who were granted access by the company to such papers that still existed relating to the project decisions.

CASE STUDY

Alumina PLC: Post-audit of capital investment expenditure

BACKGROUND

Alumina PLC has recently purchased a new platform and a crane to replace the old ones with the intention of improving work practices and reducing the need for equipment hire.

The old platform is too large to operate in confined areas and requires the erection of scaffolding for maintenance access. Scaffolding takes on average in excess of three days to erect and disassemble and disrupts production over the corresponding period. Sometimes a similar and smaller machine is hired to perform such duties. The crane does not have an operator's cab and would not normally be permitted by the appropriate safety and licensing authorities for crane and lifting operations. If the cab is to be installed, then this crane cannot be used in confined spaces, which would drastically limit the maintenance department's effectiveness. Both pieces of equipment are over 25 years old and have accumulated high maintenance costs over the last five years. The maintenance costs are set to rise as spare parts are no longer available, and have to be manufactured in most instances.

The replacement machines were jointly evaluated during the process, and a detailed cost justification was presented in the evaluation report. This exercise has resulted in the purchase, as recommended in the evaluation, of a Grove low-profile mobile crane at $140,000 and a Longreach mobile aerial platform at $60,000. This equipment replaces the existing Steelweld crane and mobile work platform.

A post-audit study was conducted on the capital expenditure evaluation process on which the purchase decision was based, with the objective of:

- identifying any deficiencies in the evaluation procedure adopted;
- identifying any key and related issues regarding the purchasing decision; and
- making recommendations to improve capital expenditure evaluation procedures in the future.

CASE STUDY (cont.)

Economic justification for purchase

Alumina PLC currently operates an aerial work platform with a 40 ft (12.2 m) high reach aerial work platform and a Steelweld crane in its major bauxite refinery operation. The work platform is used in various locations for maintenance access to valves, piping and structures, while the crane is used extensively by maintenance personnel, particularly shift maintenance, in buildings where access is tight and confined. Both units are essential for maintenance departments to carry out day-to-day activities that require aerial access or lifting capabilities in confined areas.

Mobile aerial work platform. The physical dimensions of the platform are too large for it to operate in confined areas. This then requires the erection of scaffolding to gain access to equipment such as valves, pumps and piping structures. Scaffolding takes on average in excess of three days to erect and dismantle when an appropriate aerial work platform would take less than a day. Sometimes a similar and smaller machine is hired to perform such duties. The slow travelling speed (0.5 km/hr) of the existing platform is a disadvantage and causes its non-return to the central cranes parking area. This then ties up personnel time in trying to locate the machine for use in other areas.

Steelweld crane. The existing Steelweld crane is considered to be an asset to maintenance users as it is the only crane on site that can be used in confined areas and in the rod mills, due to its low profile height and slewable jib. This crane does not have an operator's cab, and its use would not normally be allowed by the appropriate safety and licensing authorities for crane and lifting operations. If the cab were installed, then the effect on the crane's profile would mean that it could not be used in any of the confined areas for which it is currently uniquely suitable. This would drastically limit the maintenance department's effectiveness.

This crane is not easy to maintain as virtually all parts have to be manufactured and downtime can be considerable. This type of crane is obsolete and vendor technical expertise is virtually non-existent. Maintenance costs for both pieces of equipment have become exorbitant, over the last five years $37,000 for the work platform and $17,000 for the crane; further overhaul is not recommended on either since the same parts difficulties would still be encountered. The proposed replacement equipment comprises the latest models available. They are more capable and can provide a service which reduces or removes costly work practices and reduces the need for equipment hire.

Proposal

It is recommended to replace both machines with the Grove low profile mobile crane at $140,000 and the Longreach mobile aerial

CASE STUDY (cont.)

work platform at $60,000. These replacement machines would enhance maintenance effectiveness by providing the same maintenance service plus additional duties not provided by the older machines. Grove cranes are already used extensively at sister refineries and have been very reliable, accumulating low maintenance costs. The load range and extendable boom would also allow the use of this crane in areas normally serviced by the existing Steelweld crane as well as reducing hire requirements.

Another advantage is the carry decks which will eliminate the use of a dogman to accompany the crane. It is proposed to install a forklift and work platform accessories to provide additional capabilities for maintenance.

The aerial lift mobile work platform will be utilized in confined areas of low height and width and can reach up and over obstructing pipework and structures. These capabilities will eliminate the need to build scaffolding to reach valves and piping to carry out maintenance work. It is estimated that the erection and dismantling of scaffolding could cause in excess of two to three days' downtime of precipitator tanks.

Benefits

The replacement of this equipment will generate the cost savings and profit improvements detailed in Tables 4.1 and 4.2 by reducing the need for scaffolding and increasing production opportunities due to the earlier return of out-of-circuit equipment to production.

Details of the project appraisal are shown in Table 4.3. The analysis is conducted over 20 half-year periods with a tax rate of 39%,

TABLE 4.1

Cost savings for crane and platform

Cost savings ($'000)	Year 1	Year 2	Year 3	Year 4	Year 5
Crane					
Labour savings	50	50	50	50	50
Scaffold inventory	–	–	–	–	–
Increased production	–	–	–	–	–
Maintenance reduction	4.2	5.6	8.4	11.2	12.6
Hire reduction	1.28	1.28	1.28	1.28	1.28
Total	55.48	56.88	59.68	62.48	63.88
Platform					
Labour savings	–	–	–	–	–
Scaffold inventory	10	10	10	10	10
Increased production	54	54	54	54	54
Maintenance reduction	1.8	2.4	3.6	4.8	5.4
Hire reduction	5.12	5.12	5.12	5.12	5.12
Total	70.92	71.52	72.72	73.92	74.52

CASE STUDY (cont.)

TABLE 4.2

Cost savings and increased profits ($)

Savings/profits	Year 1	Year 2	Year 3	Year 4	Year 5
Labour savings	50,000	50,000	50,000	50,000	50,000
Scaffold inventory	10,000	10,000	10,000	10,000	10,000
Increased production	54,000	54,000	54,000	54,000	54,000
Maintenance reduction	6,000	8,000	12,000	16,000	18,000
Hire reductions	6,400	6,400	6,400	6,400	6,400
Total	126,400	128,400	132,400	136,400	138,400

discount factor of 13% and depreciation rate of 18% compound. Depreciation is charged half-yearly on a reducing balance basis.

Evaluation of this project leads to the following conclusions: a net present value (NPV, at 13%) of $342,000, an internal rate of return (IRR) of 54.3%, and a payback period (discounted) of 1.8 years. A post-audit of this project needs to make recommendations for the improvement of the procedure adopted. Assumptions are necessary to deal with some of the uncertainties associated with the joint consideration of costs and revenues, so a detailed sensitivity analysis is necessary to allow the two components of the project to be appraised separately.

POST-AUDIT ANALYSIS

The crane and the platform are independent of each other in the sense that they operate independently and perform their own functions in the maintenance process. There is no apparent reason for these two machines to be appraised together. The joint evaluation reveals a payback period of 1.8 years, an NPV (at 13%) of $342,000 and an IRR of 54.3% for the combined project.

When separate analyses are performed for the crane and the platform, and a comparison with the 'combined' analysis is made, an interesting picture emerges. The combined cost savings figures are shown in Table 4.2, and the following assumptions are necessary to separate the cost savings for the crane from those for the platform:

- The labour savings are entirely attributed to the crane because the new crane will eliminate the use of a dogman.
- The scaffold inventory is attributed to the platform because the old platform could not be used in confined areas, and scaffolding is required instead for maintenance.
- The increased production is attributed to the platform because the need to build and dismantle scaffolds could cause in excess of 2–3 days' downtime and consequent loss of production.
- The maintenance reduction is apportioned to align with the historical maintenance costs of the crane and platform. Based on

TABLE 4.3

Alumina PLC project appraisal

	Base	Y1		Y2		Y3		Y4		Y5		Y6		Y7		Y8		Y9		Y10	
		Y1H1	Y1H2	Y2H1	Y2H2	Y3H1	Y3H2	Y4H1	Y4H2	Y5H1	Y5H2	Y6H1	Y6H2	Y7H1	Y7H2	Y8H1	Y8H2	Y9H1	Y9H2	Y10H1	Y10H2
Investment and depreciation																					
Investment	200.0																				
Depreciation		18.0	18.0	14.8	14.8	12.1	12.1	9.9	9.9	8.1	8.1	6.7	6.7	5.5	5.5	4.5	4.5	3.7	3.7	3.0	3.0
Depreciated value	200.0	182.0	164.0	149.2	134.5	122.4	110.3	100.3	90.4	82.3	74.1	67.5	60.8	55.3	49.9	45.4	40.9	37.2	33.5	30.5	27.5
Working capital	0.0																				
Salvage	200.0																				
Cash flow from operations																					
Cash from Operations		63.2	63.2	64.2	64.2	66.2	66.2	68.2	68.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
plus salvage	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
less depreciation	0.0	18.0	18.0	14.8	14.8	12.1	12.1	9.9	9.9	8.1	8.1	6.7	6.7	5.5	5.5	4.5	4.5	3.7	3.7	3.0	3.0
Taxable income	0.0	65.2	45.2	49.4	49.4	54.1	54.1	58.3	58.3	61.1	61.1	62.5	62.5	63.7	63.7	64.7	64.7	65.5	65.5	66.2	66.2
less tax paid				43.1		38.6		42.2		45.5		47.6		48.8		49.7		50.5		51.1	
After tax cash from operations	0.0	65.2	45.2	6.4	49.4	15.5	54.1	16.1	58.3	15.6	61.1	14.9	62.5	15.0	63.7	15.0	64.7	15.0	65.5	15.1	66.2
less working capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
less investment	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus depreciation	0.0	18.0	18.0	14.8	14.8	12.1	12.1	9.9	9.9	8.1	8.1	6.7	6.7	5.5	5.5	4.5	4.5	3.7	3.7	3.0	3.0
Net cash flow	–200.0	83.2	63.2	21.1	64.2	27.6	66.2	26.0	68.2	23.7	69.2	21.6	69.2	20.4	69.2	19.5	69.2	18.7	69.2	18.1	69.2
Accumulated Net cash flow	–200.0	–116.8	–53.6	–32.5	31.7	59.4	125.6	151.6	219.8	243.5	312.7	334.3	403.5	423.9	493.1	512.6	581.8	600.5	669.7	687.8	757.0

TABLE 4.3 (cont.)

	Base	Y1		Y2		Y3		Y4		Y5		Y6		Y7		Y8		Y9		Y10	
		Y1H1	Y1H2	Y2H1	Y2H2	Y3H1	Y3H2	Y4H1	Y4H2	Y5H1	Y5H2	Y6H1	Y6H2	Y7H1	Y7H2	Y8H1	Y8H2	Y9H1	Y9H2	Y10H1	Y10H2
Discounted Cash Flow																					
Discount factor %	13.0																				
Net present value	–200.0	–121.9	–66.2	–48.7	1.3	21.4	66.8	83.5	124.7	138.2	175.1	185.9	218.4	227.4	256.0	263.6	288.9	295.3	317.6	323.0	342.7
Benefit–cost ratio	0.0	0.4	0.7	0.8	1.0	1.1	1.3	1.4	1.6	1.7	1.9	1.9	2.1	2.1	2.3	2.3	2.4	2.5	2.6	2.6	2.7
IRR		0.0	0.0	0.0	13.6	22.2	35.3	38.7	44.8	46.2	49.3	50.0	51.6	52.0	52.9	53.1	53.6	53.7	54.0	54.1	54.3
Discount factor period			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
NPV			757.0	710.3	666.9	626.4	588.7	553.5	520.7	490.0	461.3	434.5	409.3	385.7	363.5	342.7	323.1	304.6	287.2	270.8	255.4

CASE STUDY (cont.)

the calculation, a 70–30 split of this cost variable is derived for respectively the crane and the platform.

- The hire reductions are apportioned so that 80% is due to platform and 20% due to the crane. The new platform can access confined spaces while the new crane can handle extreme lifting requirements.

This yields the separate cost saving figures in Table 4.2 for subsequent analysis. These figures, together with nominal salvage values of $10,000 for each machine, allow the calculation of the return on investment in terms of NPV and IRR:

	Crane	Platform
NPV ($000)	94.8	244.9
IRR (%)	30.3	111.9

It is apparent that the NPV for the platform is consistently above the 'combined' NPV, whilst the NPV for the crane is below that for the combined project. This shows that the return on investment for the new platform *subsidizes* the investment for the new crane.

The payback period for the platform is less than 1 year, whilst the payback for the crane is about 4 years. It is clear that the 'combined' evaluation has obscured the true picture if the machines are appraised separately.

Based on the cost savings for the crane and the platform a sensitivity analysis can be conducted by varying the cost savings factors. A standard variation of ±30% is adopted for the pessimistic and optimistic cases. Table 4.4 shows the NPVs of each investment

TABLE 4.4

Sensitivity analysis for crane and platform

Cost Savings	Crane			Platform		
NPV ($'000)	Pessimistic	Expected	Optimistic	Pessimistic	Expected	Optimistic
Labour savings	39.9	94.8	149.6	244.9	244.9	244.9
Scaffold inventory	94.8	94.8	94.8	234.0	244.9	255.9
Increased production	94.8	94.8	94.8	185.7	244.9	304.1
Maintenance reduction	90.3	94.8	99.3	234.4	244.9	255.5
Hire reduction	93.4	94.8	96.2	239.3	244.9	250.5
IRR (%)						
Labour savings	20.5	30.3	39.7	111.9	111.9	111.9
Scaffold inventory	30.3	30.3	30.3	107.3	111.9	116.6
Increased production	30.3	30.3	30.3	87.3	111.9	137.2
Maintenance reduction	29.6	30.3	30.9	109.2	111.9	114.6
Hire reduction	30.0	30.3	30.5	109.6	111.9	114.3

CASE STUDY (cont.)

with the separate variation of each of the cost saving factors. The outcomes highlight the importance of accurate estimates of labour savings and production improvements resulting from the investment. The scaffold inventory, maintenance and hire factors are all relatively robust in their impact. The worst scenario occurs where all cost saving factors are at –30% of their expected estimates, and the best scenario is defined where all cost saving factors are at +30% of their expected estimates.

The return on investment for the crane and the platform for best and worst scenarios is as follows:

	Crane		Platform	
	Best	**Worst**	**Best**	**Worst**
NPV ($000)	155.5	34.0	331.3	158.6
IRR (%)	40.6	19.5	146.9	77.6

Given the absence of any clear logic in the amalgamation of the two projects for evaluation, we might speculate that the manager put together the evaluation of these machines for the following purposes:

- to cover the embarrassingly high return on investment for the platform, which might have led the management to question why the purchase was not proposed much earlier;
- to cover the lower than expected return on investment for the crane, which might not be as appealing when it was evaluated independently (a better picture could be presented when combined with the high investment return of the platform);
- to ensure the purchase of the crane when it was neither economically viable, nor justifiable on health and safety grounds.

The report presented focuses on the financial justification of the replacement machines. The non-financial aspects of the investment are not explored. Issues such as the safety standard and after-sales services of the machines should be considered. Human factors of the investment should be considered, too. The proposed elimination of the dogman with the purchase of the new crane might result in union objections.

RECOMMENDATIONS

1 The immediate purchase of the platform would be a good investment decision, but the purchase of the crane could be delayed for a few years due to its less favourable return. The delay in purchase of the crane would give the management more time to explore alternatives.
2 Sensitivity analysis on the variables that impact on the cash-flow situation of the investment gives management a much better picture. The labour savings factor has the most impact on the

CASE STUDY (cont.)

cash-flow situation for the purchase of the crane. Management should look more closely at financial and non-financial implications of variation of this factor. Increased production is the most significant factor in the purchase of the platform. Management should study possible variations in production and its effect on the cash-flow situation.

3 The findings of the post-audit should be well documented and incorporated into the company's knowledge base such that the experiences gained could benefit the whole company. When the findings of this evaluation were reported to the company they immediately outlawed the (then still current) practice of amalgamating unrelated investment projects for the purpose of evaluation.

SUMMARY

Although 'costs' might be perceived to be the major focus of this chapter, hopefully they can now be perceived from both a qualitative as well as quantitative perspective. While we adopted some relatively sophisticated methods of data analysis, our focus was drawn more to the 'beginning' and 'end' of the appraisal process. We were concerned with where the numbers came from: the assumptions and hidden agendas involved, and the creativity in their generation. We were also concerned with the sensitivity of our outcomes to alternative assumptions. But, most importantly, we were concerned with the non-financial factors which are potentially the overriding influence in the decision-making process, and some of the behavioural considerations which make them so.