

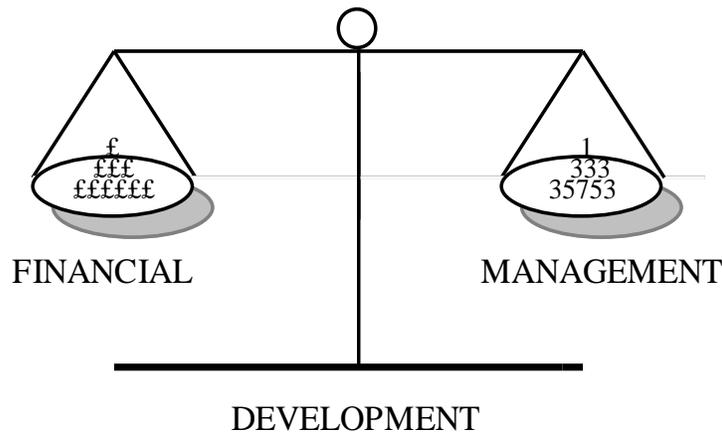
FINANCIAL MANAGEMENT DEVELOPMENT

Decision Making

Capital Expenditure

NO 336

DEALING WITH UNCERTAINTY IN MANAGEMENT DECISIONS



ONE OF A SERIES OF GUIDES FOR
FINANCIAL MANAGEMENT DEVELOPMENT
FROM

www.FinancialManagementDevelopment.com

This is one of a series of documents produced by David A Palmer as a guide for managers on specific financial topics to assist informed discussion. Readers should take appropriate advice before acting upon any of the issues raised.

DEALING WITH UNCERTAINTY IN MANAGEMENT DECISIONS

The Theory

In many decisions it is necessary to consider uncertainty. In particular, investment decisions which involve a choice of actions frequently involve the need to assign probabilities to potential outcomes in order to reach a decision. The theories behind the approach are well established, the problem lies in putting them into a practical context. In many instances the manager is tempted to rely on intuition because of the difficulty of identifying the alternative options, quantifying the likelihood of each under various assumptions and assigning probabilities to each. However, like many other management techniques, the value lies in the approach which forces consideration of the various options, rather than the level of precision of the outcome. Practical implementation lies in knowing when to stop collecting facts and start estimating.

Games theory originated in the Second World War and is the basis for most established published works. It starts with an evaluation of the choices available to each party in a zero sum two person game. That is a game where losses are matched by equivalent gains for the other player. The theory works by drawing up a matrix of possible outcomes and then assuming that each player will wish to minimise the maximum possible damage to themselves (MINIMAX). The theories assume that players have to make simultaneous decisions i.e. they cannot wait to see what the other will do. Whilst the mathematics can be extremely complex the use of the theory to assess the impact of decisions is common in marketing and selling initiatives where competitor reaction is a key risk factor.

The Matrix Approach

At its simplest the theory covers the situation where two players are faced with various alternatives which they have costed out. A typical matrix might be:

		Player B		
		Option 1	2	3
Player A	Option 1	4	-3	1
	2	2	3	-4
	3	-2	1	2

Where the figure in the matrix represents an amount to be paid by A to B as positive and an amount to be paid by B to A as negative.

If both players attempt to minimise their worst position the following strategies will result.

Player B	Option	Worst Result
	1	-2
	2	-3
	3	-4

Player B will opt for his option 1 which gives the least worst result and pay 2 to A.

Player A	Option	Worst Result
	1	4
	2	3
	3	2

Player A will opt for his option 3 which gives the least worst result i.e. he would pay 2 to B.

The net results of both players adopting these strategies is that Player A will be paid 2 by Player B which is described as the value of the game.

The application of the theory can be extremely beneficial in encouraging managers to consider the options, estimate likely competitor reaction and put a values on the outcomes. In addition it can also be useful in identifying any strategies which are the least good under any circumstances and which should therefore never be adopted. One further benefit is that it enables a price to be put on finding out a competitors intentions. In particular non-zero sum situations can lead to establishment of the benefit of collusion.

The Prisoner's Dilemma

Two accomplices are charged with a series crime. They are to be interviewed separately and have been each told that if one confesses and the other does not, the one who confesses will go free while the other will receive a severe sentence. They both know that if nether confesses then they will both receive a small sentence for minor offences. In a matrix the position for each prisoner is:

	Confess	Deny Charge
Accomplice confesses	2 years	5 years
Accomplice denies charge	Go free	6 months

Without collusion they are both likely to confess and receive 2 years each. If they have the opportunity to agree strategy they will both deny the charge and receive 6 months each.

The implications for this are not lost on Sales Directors of organisations in an oligopoly situation when considering pricing.

Probability Theory

In many management decision situations the outcome of strategy is not so much dependent upon the action of a single known competitive player but is more dependent upon chance. In certain situations the Theory of Games suggests that the response to dealing with chance should be to use some form of random number generator to assist the decision-making process. Rolling a dice is frequently cited as the way to stimulate random events. However, managers in real life often seem reluctant to delegate their decisions to a set of dice, despite the academic backing to the theory. One area where it has found favour is in statistical sampling. In particular the auditing profession has taken the use of statistical sampling techniques based on computerised number generation as a way of turning the art of auditing into a science.

Perhaps the most useful application of games theory comes in the area of financial evaluation of alternative courses of action under differing scenarios. At its simplest the matrix appears similar to that in the two person game. The difference lies in the assigning of probability to the various possible scenarios. A typical example would be a financing decision. Should money be borrowed at fixed rates or variable rates? The matrix for a decision regarding £1 million at current rates of 6% would be:

	Interest Rates Rise 1%	Interest Rates Static	Interest Fall 1%
Borrow Fixed Rate	£60,000	£60,000	£60,000
Borrow Variable Rate	£70,000	£60,000	£50,000
Probability (total 100%)	30%	40%	30%

(the probability assigned to the three scenarios have been simplified. In practice larger variations in rates could be included in the evaluation).The expected outcome may now be calculated as follows:

$$\begin{aligned} \text{Fixed Rate} &= (60,000 \times 0.3) + (60,000 \times 0.4) + (60,000 \times 0.3) \\ \text{Variable Rate} &= (70,000 \times 0.3) + (60,000 \times 0.4) + (50,000 \times 0.3) \end{aligned}$$

or £60,000 under either scenario.

It would be reasonable at this stage to question the usefulness of the knowledge produced by this calculation. However, what the matrix does is provide the basis for decision making. If the maximum available funds are £60,000 then the taking of a risk (to gain the benefit that the cost may be only £50,000) may not be considered worthwhile. The benefit of using the games theory approach is that it forces consideration of the impact of possible "disastrous" scenarios. The technique is presumably not adopted by the Directors when they finance acquisitions with overdrafts. A matrix might be:

	Interest Rates Rise	Interest Rates Fall
By using overdraft	Wreck Company/lose jobs	A better profit
By using fixed rate loans	Sleep at night	Sleep at night

In Summary

Although the mathematical and academic backing is impeccable the real value of games theory in helping with uncertainty is that it forces consideration of all options. The subjective view of the various outcomes can then be applied to decide from the combination of probability and relative weighting of outcomes which is the best courses of action to adopt.

A practical example:

A typical accountant's decision might be whether to take an umbrella on a day's holiday. The matrix includes the following options:

- Take umbrella
- Buy umbrella (if it rains)
- Get wet

Being an accountant he has calculated the nuisance cost of having an unnecessary umbrella at £10 for the day. A new umbrella would cost £25. For the cost of getting wet he has decided it should be the cost of his day off in terms of lost salary (i.e. the day is wasted) at £150.

The weather forecast states that there is a 10% chance of rain. The matrix is:

	Rain	Dry	Expected Cost
Probability	10%	90%	
Option: Take umbrella	0	-10	-9
No umbrella	-150	-	-15
If wet			
Buy umbrella	-25	n/a	-2.5

Thus this accountant will not take his umbrella but buy one if it rains. If however, the probability of rain was 50% he would have taken his umbrella, since the options would have costs of -5 (take) and -12,5 (buy if wet). Since in the UK it rains as often as not this explains why all accountants carry umbrellas but not why they wear bowler hats.

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David is an experienced financial professional who has devoted his skills to management training in practical understanding and utilisation of financial information. A Graduate, Chartered Accountant, and Associate of the Institute of Taxation, he is also a Member of the Chartered Institute of Personnel and Development and has been an Ordained as a Deacon in the Catholic Church.

He has worked as a Financial Controller and Company Secretary in the Finance industry and as a Director of Finance and Administration in the Computer Services industry. Since 1990 he has conducted management development programmes for over forty major organisations including Arla Foods, Blue Circle, BP, CSC Computer Sciences, Conoco, Ernst & Young, Lloyds Bowmaker, Royal Mail, Unilever and Zeneca. He also runs programmes for the Leadership Foundation and the management teams at a number of Universities. International training experience includes work in Belgium and Holland for CSC, in Denmark, Kenya and the Czech Republic for Unilever, in Holland and the US for Zeneca, in Dubai for Al Atheer, in Bahrain and Saudi Arabia for Cable & Wireless.

He specialises in programmes in financial management for both tactical and strategic decision making. In addition he has run courses in acquisition evaluation (The Economist, Eversheds, Blue Circle and Hays Chemicals) and in post-acquisition management (Unilever). All training is specifically tailored to the needs of the organisation with the emphasis on practical applications to enhance profitability and cashflow. He has developed material for delivery by in-house personnel (Royal Mail, Lloyds Bowmaker and Conoco), computer based training packages (The Post Office, Unilever and BP), and post course reinforcement self-study workbooks (CSC and Zeneca). He has also produced a training video on Cashflow Management.

He is a prolific writer of case studies, role plays and course material. He has also published articles on the financial justification of training, financial evaluation of IT investment proposals, the use of Activity Based Costing and Customer Profitability statements, commercial considerations for consultants, the need for taxation awareness training for general managers, evangelisation and Christian business ethics.

Many of his generic documents are freely available on his website:

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In addition to his Diaconal work in the Church, he has held a number of voluntary positions including University, College and School Governor, Hospice Treasurer and Trustee of various charitable institutions. He continues to provide ad hoc commercial advice to several other charitable organisations. He has been married for over 35 years and has one daughter and three granddaughters.

This series of papers is designed to help managers by providing a basic understanding of key financial concepts to assist them in their work. It is provided at no cost since this knowledge is a Gift from God and thus to be shared (Matthew 10:8).