

QUANTITATIVE METHODS FOR DECISION MAKERS

MIK WISNIEWSKI

**PITMAN
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Quantitative Methods for Decision Makers

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Dedicated to Hazel to whom I promised after the last book that I'd never write another.

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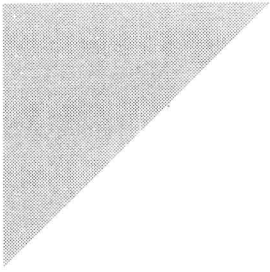
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Quantitative Methods for Decision Makers



Preface

The contributions that can be made to improved management decision making through the application of quantitative techniques are well researched. There is extensive empirical evidence that the relevant application of such techniques has resulted in significant improvements in economic efficiency – particularly at the microeconomic level – and have led to improvements in decision making in both profit and non-profit sector organisations. Numerous professional journals regularly provide details of ‘successful’ applications of such techniques to specific business problems.

This is, arguably, one of the major reasons why there has been in recent years a considerable expansion of the coverage of such topics throughout business studies programmes in the higher education sector not only in the UK but also across much of Western Europe. Not only postgraduate courses (such as MBAs) and professional courses (in finance, banking and related fields) but most, if not all, business undergraduate courses nowadays expose the student to basic quantitative techniques. It is no longer simply the specialist who is introduced to these topics but, in numerical terms far more importantly, a large number of students who go on to a career in general management.

Coupled with this development has been the revolution that has occurred in making available powerful and cost-effective computing power on the manager’s desk top. Not only has this meant that the manager now has instant access to available business information but also that techniques which used to be the prerogative of the specialist can be used directly by the manager through the use of appropriate – and relatively cheap and user-friendly – computer software.

Because of these developments it is increasingly important for managers to develop a general awareness and understanding of the more commonly used techniques and it is because of this that this textbook was written. There is a plethora of textbooks covering the quantitative field and the author was reluctant simply to add another. However MBA students – and those studying at equivalent levels – often have different needs and require a different appreciation of these techniques and it was for this audience that this text was written. The text aims to provide the reader with a detailed understanding of both the role and purpose of quantitative techniques in effective management and in the process of

managerial decision making. Not only does the text focus on the development of appropriate skills but also with the development of an understanding as to how such techniques fit into the wider management process. By the end of the text the reader should be able to use directly some of the basic techniques introduced, should have an awareness of common areas of business application and should have developed both sufficient confidence and understanding to commission appropriate applications of more complex techniques and contribute to the evaluation of the results of such analysis.



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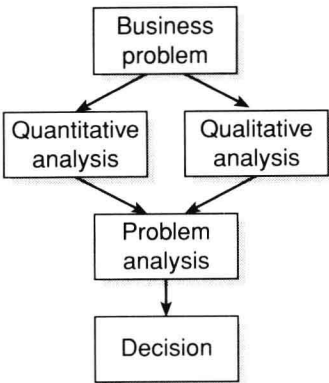
Introduction

This book introduces the major mathematical and statistical techniques used by managers in all types of business organisation – large and small, private sector and public sector, profit-oriented and non-profit making, manufacturing and service sector – to help them with decision making. In an increasingly complex business environment managers have to grapple with problems and issues which range from the relatively trivial – which make of photocopier will prove more reliable and cost effective – to the strategic – which products or services do we continue to deliver and which do we discontinue. Increasingly, managers are expected to be able to justify the decisions they reach on the basis of logic and hard analysis not just on judgement and experience. In such an environment the techniques we shall be examining have an important part to play.

We do not pretend that these techniques offer the manager an instant solution to the problems faced. They do offer a method of analysing a problem using proven techniques, of providing information about that problem and of assessing the potential outcomes from different decisions. This is not to say, however, that management decision making is simply about the application of such techniques. It clearly is not. However, such techniques can provide valuable information about a business problem that may not be available from any other source. But such information is only part of the problem. The manager must assess the information generated by techniques alongside that available from Finance, from Engineering, from Sales, from Personnel and so on. Like any piece of information the manager must be in a position to assess its reliability and its potential usefulness.

This is why in this text the focus is very much on an understanding of the general principles – from a management perspective – behind each technique. It is not the intention of the text to turn you into an ‘expert’ in the use of such techniques although you will develop skills in the practical aspects of many of these as we progress. Rather it is to enable you to appreciate when such techniques may be useful in your decision-making capacity and to provide you with an insight into how the information generated by such techniques can be evaluated and used. It is important to realise that information from these techniques forms only part of the decision-making process. Figure 1.1 illustrates this in a simplistic way. A business problem needs to be examined both from a quantitative and a qualitative perspective. Information about the problem from both of these perspectives needs to be brought together and assessed in the context of the problem. Based on some mixture of the two sources of information a decision will be taken by the manager.

Fig. 1.1
The decision-making
process



THE USE OF QUANTITATIVE TECHNIQUES BY BUSINESS

It is tempting to assume that the use of quantitative techniques in business is restricted to the mathematical and statistical specialist. Whilst this may have been the case in the past – and for the more complex and specialist applications still is – increasingly the decision maker in the organisation is expected to be aware of and to be able to assess such techniques in terms of the information they generate and the potential use (or otherwise) of that information. Much research has been undertaken in the United States into the use of such techniques by business. More limited research is available for Europe but what is available provides an interesting insight into the use of techniques and into the focus of this text and its intended readership. The author is part of a European-wide research team investigating the use of techniques by businesses and their effectiveness in terms of organisational performance. Part of the research focused on a sample of businesses in Europe. Questionnaires were sent to the chief executive (not to the quantitative specialist) of a sample of businesses in a number of countries. Firms were asked whether quantitative techniques were used by the business. Table 1.1 indicates that around two thirds of firms responding indicated they used at least some of the techniques. The survey also revealed that larger firms (those employing more than 200) were more likely to use such techniques than smaller firms.

Table 1.1
Percentage of
respondents using
techniques

<i>Techniques used</i>	66%
<i>Techniques not used</i>	34%

Source: EMSS.

Firms were also asked to comment on the perceived usefulness of the techniques for their business. Table 1.2 shows the responses.

Table 1.2
Usefulness of techniques

<i>Extent of usefulness</i>	<i>Percentage of respondents</i>
No use	0.7
Little use	8.7
Useful	42.5
Very useful	24.0
Essential	24.0
Total	100.0

Less than 10 per cent of firms using techniques thought that such techniques were of little or no use for their business whilst almost a quarter felt they were essential. Remember that respondents were by and large managers in these organisations not mathematical and statistical specialists. Firms were also asked which quantitative techniques they used. Although we must be cautious about a direct comparison between the techniques specified in the survey and the corresponding chapters in this text – since some of the text chapters cover wider issues than a single technique – it is interesting to compare the two. Table 1.3 shows the results.

Table 1.3
Use of individual techniques

<i>Technique</i>	<i>Percentage of firms using the technique *</i>	<i>Textbook chapter</i>
Basic statistics	89%	3,4
Probability and inference	36%	5,7
Decision analysis	67%	6
Quality control	77%	8
Smoothing methods	67%	9
Regression	53%	10
Linear programming	40%	11
Stock control	75%	12
Project management	43%	13
Simulation	62%	14
Discounted cash flow	81%	15

* Limited to those firms who were aware of a technique.

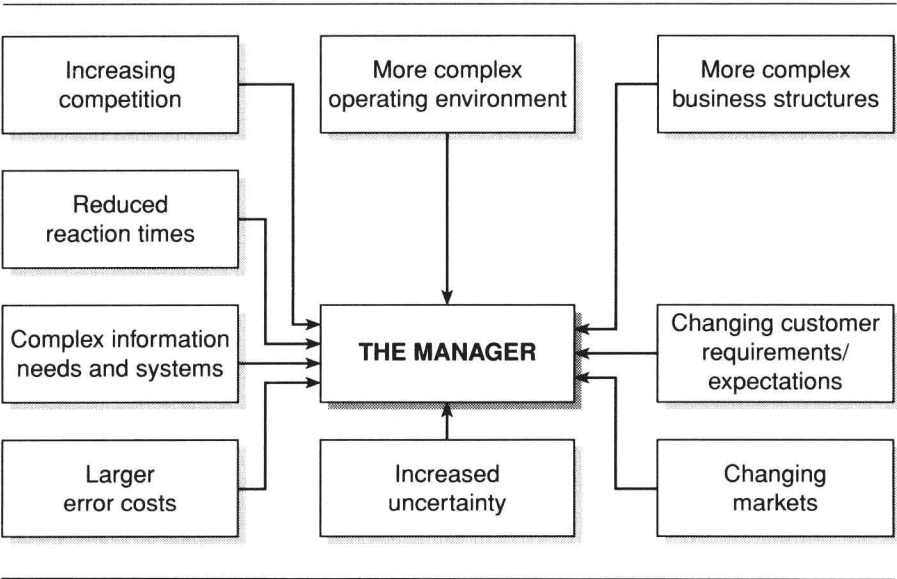
It can be seen that the techniques we shall be introducing are those in common use by managers in a wide variety of business organisations. They are included in the text because of their impact on the decision-making process not because of pure academic interest.

Firms *not* using these techniques were also asked as to the reasons why such techniques were not used. 39 per cent of these firms responded that one of the factors contributing to non-use was insufficient training and education of staff in the use of these techniques. This is a stark illustration of why managers need to develop skills and awareness in the quantitative area.

THE ROLE OF QUANTITATIVE TECHNIQUES IN BUSINESS

It will be worth while at this stage considering the specific role of quantitative techniques in the wider business decision-making context. Whilst this text inevitably focuses on a number of common techniques – both in terms of their basic principles and their typical uses – business decision making is more than simply the application of a technique to a problem. It is worth considering what the overall purpose of such techniques is in relation to the decision maker. Such techniques aim to improve decision making within an organisation. Figure 1.2 illustrates the complexity facing any manager today. The diagram is not meant to be exhaustive in terms of the factors impacting on the manager but does illustrate the increasing pressures.

Fig. 1.2
The manager and the decision-making environment



Organisations generally find themselves operating in an increasingly complex environment. Changes in government policy, privatisation, increasing involvement of the European Community (EC), political and

economic changes in Eastern Europe, all contribute to this complexity. At the same time organisations face increasing competition from both home and abroad. Markets that were thought to be secure are lost to competitors. In the public sector the competitive tender process forces some services to operate directly in a competitive manner. At the same time the markets available to organisations are widening. This combines with increasing pressures from customers in terms both of their requirements and their expectations. The drive for quality and customer satisfaction gathers pace. Because of the increasing complexity and the other changes occurring, the information needs of a manager become more complex and demanding also. With the pace of increasing competition – and with continual improvements in telecommunications – the time available to a manager to assess, analyse and react to a problem or opportunity is much reduced. Managers – and their supporting information systems – need to take fast, and hopefully appropriate, decisions. The consequences of wrong decisions, however, become more serious and costly. Entering the wrong markets, producing the wrong products, providing inappropriate services will have major, often disastrous, consequences for organisations.

All of this implies that anything which can help the manager of an organisation in facing up to these pressures and difficulties in the decision-making process must be seriously considered. Not surprisingly this is where quantitative techniques have a role to play. This is not to say that such techniques will automatically resolve such problems. But they can provide both information about a problem and a different way of examining that problem that may well help. Naturally such quantitative analysis will produce information that must be assessed and used in conjunction with other sources. Business problems are rarely, if ever, tackled solely from the quantitative perspective. Much qualitative assessment must also take place. For example, consider a local authority considering the replacement of some of its refuse collection vehicles. We may well be able to apply a number of quantitative techniques to this situation – applying financial analysis principles, examining patterns and trends in refuse collection, comparing this vehicle's performance with other vehicles, forecasting the likely demand for refuse collection over the life of the vehicle and so on. However, before reaching a decision, other factors and information will need to be considered. Is this the right time 'politically' to be making what may be a major capital investment? How will the workforce react to a new vehicle – given this may require some retraining – and to what may be new modes or methods of working? Will the management of this service be able to cope with the problems that such a change will bring? All of these factors and more will need to be taken into account by the manager before reaching a decision. Clearly techniques have a potentially important role to play in helping reach a decision but they are not sufficient by themselves.