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Management Accounting – Decision Management

What effect do risk and uncertainty have on decision-making? **Tim Thompson** considers some of the techniques that can be used to evaluate an opportunity.



We all have different expectations, aspirations and fears. Some people have an optimistic view of life, whereas others are pessimists. It follows that two people, when faced with the same opportunity, could well arrive at two different decisions about it based upon their different outlooks.

The concepts of risk and uncertainty are based on the recognition that a number of possible outcomes can emerge from a decision. The wider the range of these outcomes, the more risky (or uncertain) the situation. The difference between risk and uncertainty is the extent to which the number, value and likelihood of the outcomes can be confidently quantified.

An example of risk can be derived from a pack of playing cards. If we are presented with a full pack and draw one card at random, we can calculate with confidence the probability that this card will be the ace of spades. We know that 52 outcomes are possible, because there are that many cards in the pack. We also know exactly what these outcomes are, because each card is unique and identifiable. So, we can state with confidence that the probability of drawing the ace of spades is one in 52 or 1.923 per cent.

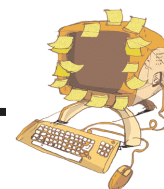
But the analogy of picking a playing card doesn't really reflect the unpredictable nature of business decision-making. Such decisions are characterised by a high degree of uniqueness. Accordingly, it's difficult to identify every possible outcome and even harder to establish the likelihood of each of these outcomes. This is called uncertainty.

Despite the clear difference between risk and uncertainty, there is a paradox: managers tend to ignore (or at least work around) this distinction for decision-making purposes. To evaluate a business decision involving uncertainty, managers will use their judgment – ie, educated guesswork – to predict as best they can all of the possible outcomes and their associated probabilities. In so doing, they treat an uncertain situation as if it were characterised by risk. In practice, management accounting techniques also usually treat risk and uncertainty as the same thing. From now on, therefore, I will use risk as the blanket term to cover both risk and uncertainty.

One of the models used to describe different individuals' attitudes to risk identifies three classifications as follows:

- **Risk-seeking.** This term means that an individual seeks risk not as an end itself, but rather as a means to an end. Recognising the established link between risk and return, the individual seeks a very high return and accepts the high level of risk that normally accompanies it. This attitude may, for example, be exhibited by an entrepreneur who plans to set up a new business in the hope of becoming a millionaire. In order to achieve this, he might need to take out a substantial loan and he will willingly risk all of his personal assets as security for his borrowings.
- **Risk-averse.** This attitude is concerned with limiting risk. At an extreme level, it's where an individual adopts an ultra-cautious approach and eliminates as much risk as possible. In so doing, the individual must accept the low returns that normally accompany this low risk level. In practice, though,

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the term is not usually perceived in this extreme way. A less radical interpretation is that risk-aversion describes the way that rational individuals are expected to deal with risk. For a given level of risk, rational decision-makers will seek the highest rate of return. Alternatively, for a given rate of return, they will seek the lowest level of associated risk.

■ **Risk-neutral.** A risk-neutral individual pays no attention to the range of the outcomes that may emerge from a decision. Instead he focuses on a single value that represents the situation facing him. Statistical averages are often used for this, although simply focusing on the most likely outcome would also fall under the risk-neutral classification.

Let's consider a practical example. A fruit trader plans to travel to market tomorrow. He has a small stall at the market and a limited amount of cash available to buy stock to sell. Accordingly, he can select only one type of fruit to buy from the wholesaler today ready for tomorrow's market. There are four types of fruit to choose from: apples, oranges, pears and strawberries. From past experience, the trader expects that trading conditions tomorrow will fall under one of four categories: bad, poor, fair or good. These conditions are equally likely. Again, drawing from his experience, the trader has quantified the profit or loss that he thinks he will earn tomorrow, depending upon his choice of fruit and the trading conditions. These are shown in table 1 at the top of the page.

Let's now consider some of the alternative approaches that our trader might take to determine which type of fruit he will buy and take to the market, depending on his attitude to risk.

The maximin approach

This involves looking only at the worst possible outcome for each of the four types of fruit we can choose from – ie, we will focus on bad trading conditions only. We need to seek the best result among the four types of fruit in these conditions, although it might be more accurate to say that, since all of these outcomes are loss-making, we're looking for the least worst result. In so doing, we completely ignore the outcomes that might emerge if trading conditions turn out to be better. Clearly, the fruit of choice under the maximin approach will be



1 PROFIT (LOSS) ESTIMATION ACCORDING TO FRUIT CHOICE AND TRADING CONDITIONS

	Apples	Pears	Oranges	Strawberries
Bad conditions	(£1,000)	(£1,200)	(£300)	(£600)
Poor conditions	(£200)	(£400)	(£100)	(£300)
Fair conditions	£600	£700	£200	£100
Good conditions	£1,000	£1,200	£400	£440

2 QUANTIFICATION OF REGRET FELT ACCORDING TO FRUIT CHOICE AND TRADING CONDITIONS

	Apples	Pears	Oranges	Strawberries
Bad conditions	£700	£900	None	£300
Poor conditions	£100	£300	None	£200
Fair conditions	£100	None	£500	£600
Good conditions	£200	None	£800	£760

oranges, since the anticipated loss of £300 is the least worst of the four. Such an ultra-cautious approach indicates an aversion to risk that may be based upon some deep-rooted fear of failure.

The maximax approach

Here we are looking for the opportunity that offers the highest possible return. We will consider only the best trading conditions, completely ignoring what might happen under fair, poor and bad conditions. This would lead us to choose pears, because they offer the highest possible profit of £1,200.

In hoping that good trading conditions will prevail, we are taking an optimistic view of the situation. We don't worry about the possibility of trying to sell pears under bad trading conditions and the potential loss of £1,200.

The minimax-regret approach

Sometimes known simply as "regret", this approach informs a decision today based upon how our trader might feel at the end of tomorrow's trading. Having chosen the type of fruit he will sell, his success at the market will depend on the trading conditions that emerge, which he cannot choose.

His choice of fruit may turn out to be the best for the trading conditions that emerge and, if so, he will be happy. Alternatively, the trader may come to the end of tomorrow's trading feeling regretful. This will happen if he failed to choose the right fruit for the trading conditions that actually

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emerged. If, for example, the trader selects oranges and trading conditions turn out to be bad, he will not regret his choice, as this fruit will have yielded the least worst loss of £300. But, if trading conditions turn out to be good, the trader will regret having chosen oranges rather than pears, which would have provided a much higher profit of £1,200. We can not only identify that this regret will exist; we can also quantify it. Having earned a profit of only £400 with oranges instead of £1,200, the amount of regret will be £800.

For each trading condition, one type of fruit will yield no regret, since it would represent the best choice. Oranges will be the regret-free choice under bad or poor conditions, while pears will be the regret-free choice under fair or good conditions. From this, we can derive table 2 (see previous page), which quantifies the regret that the trader would feel in hindsight for each combination of fruit and trading condition. The key point here is that, although regret is a retrospective feeling, these figures are known in advance and the trader can use the information to choose the fruit for tomorrow's market. The trader will select the type of fruit whose maximum potential regret is the lowest of the four. He will therefore choose apples, which will give him a maximum possible regret of only £700, compared with £900 for pears, £800 for oranges and £760 for strawberries.

3 EXPECTED-VALUE CALCULATION FOR APPLES

	x	p	px
Bad conditions	(£1,000)	0.25	(£250)
Poor conditions	(£200)	0.25	(£50)
Fair conditions	£600	0.25	£150
Good conditions	£1,000	0.25	£250
			£100 = $\sum px$

4 EXPECTED-VALUE CALCULATION FOR PEARS

	x	p	px
Bad conditions	(£1,200)	0.25	(£300)
Poor conditions	(£400)	0.25	(£100)
Fair conditions	£700	0.25	£175
Good conditions	£1,200	0.25	£300
			£75 = $\sum px$

There is evidence of an aversion to risk in this approach. The trader does not make profit or loss the prime focus of his decision-making, but he does consider how badly he might feel tomorrow if things do not work out well.

The expected-value approach
The trader will calculate a single figure for each fruit type that represents all of the possible outcomes for that fruit and their respective probabilities. In other words, the expected value is the weighted average of the probability distribution.
The formula for this is: expected value = $\sum px$, where x is the value of each outcome and p is the associated probability. See tables 3 to 6, above, for the expected-value calculations for each



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5 EXPECTED-VALUE CALCULATION FOR ORANGES

	x	p	px
Bad conditions	(£300)	0.25	(£75)
Poor conditions	(£100)	0.25	(£25)
Fair conditions	£200	0.25	£50
Good conditions	£400	0.25	£100
			£50 = $\sum px$

6 EXPECTED-VALUE CALCULATION FOR STRAWBERRIES

	x	p	px
Bad conditions	(£600)	0.25	(£150)
Poor conditions	(£300)	0.25	(£75)
Fair conditions	£100	0.25	£25
Good conditions	£440	0.25	£110
			(£90) = $\sum px$

type of fruit. The trader will choose the type of fruit with the highest expected value – in this case apples, with £100. Although this is called the expected value, one thing that the trader will not expect tomorrow is a profit of £100. This is not one of the four possible outcomes that selling apples offers on a single day of trading. What this expected value means is that, if the trader went regularly to market and sold apples every time, over time his average profit would be expected to be £100.

In focusing solely on the weighted average of the outcomes, the trader ignores the danger of losing £1,000 on any one day. He also ignores the possibility of making a £1,000 profit. For this reason the expected-value approach is described as risk-neutral. It tells us that selling apples is the best long-term decision. This

is also the recommendation if we take the expected-value approach for our short-term decision about tomorrow's market.

Commercial organisations exist to make profits for their owners and it's the responsibility of managers to make decisions that will yield these profits. But managers are human and so are subject to the fears, hopes and expectations that affect us all. The way that they react to these pressures helps to determine their view of risk, which can influence their decisions.

The maximin and minimax-regret approaches both reflect an aversion to risk, whereas maximax is clearly a risk-seeking approach. On the other hand, the expected-value approach is seen as risk-neutral – it does not actively seek risk, but it does imply at least a tacit willingness to accept it.

In summary, the following decisions would emerge from taking each of the four approaches under consideration: under the maximin approach the trader would choose oranges; under maximax he would choose pears; under minimax-regret he would choose apples; and under expected-value he would also choose apples. There is a consensus that choosing to sell strawberries is inappropriate, but any of the remaining three types of fruit could be chosen otherwise, depending on the trader's attitude. **FM**

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P2 Recommended reading

C Wilks, *Management Accounting – Decision Management Study System*, 2005 edition, CIMA Publishing, 2004.

C Drury, *Management and Cost Accounting*, International Thomson Business Press, 2000.

C Horngren et al, *Management and Cost Accounting*, FT/Prentice Hall, 2002.

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