

Decision trees

Making decisions is a key element of a manager's job. One technique for reaching decisions is by using decision trees. **Helen Coupland-Smith** examines this particular approach

Decision making plays a dominant role throughout A2 business studies, with scientific approaches such as investment appraisal techniques and the marketing model being weighed up against the alternative of basing a decision on hunch or gut instinct. Decisions involve risk and there is always an opportunity cost involved. Decision trees are one more scientific technique available to help managers analyse the alternative courses of action in order to choose the best one.

What are decision trees?

Decision trees are a visual and numerical way of setting out the risks and rewards associated with alternative options. They provide a balanced picture for helping to choose between the options, by projecting likely outcomes. Decision trees identify:

- the choices available when a decision has to be made
- the possible outcomes related to each choice, e.g. success or failure
- the probability of each outcome occurring
- the estimated financial result of each outcome

Decision trees are drawn using squares, circles and lines:

- a square indicates where a decision has to be made (this is within the firm's control)
- a circle indicates a chance, where there are a number of different possible outcomes (this is outside the firm's control)
- a line indicates a possible choice or outcome

When are decision trees a useful tool?

Decisions are made by managers all the time. Some of these are low risk and fairly routine, such as reordering basic supplies;

Table 1 Decision table

Option	Initial cost	Success		Failure	
		Probability	Expected outcome	Probability	Expected outcome
Increase production	£23,000	0.7	£84,000	0.3	(£14,000)
Café and picnic site	£6,000	0.5	£45,000	0.5	£4,000

Table 2 Assessing the options

Increasing production					
Success		$£84,000 \times 0.70$	=		£58,800
Failure		$(£14,000) \times 0.30$	=		(£4,200)
Expected value		$£58,800 + (£4,200)$	=		£54,600
Less cost					<u>£23,000</u>
Net benefit					£31,600
Café and picnic site					
Success		$£45,000 \times 0.50$	=		£22,500
Failure		$£4,000 \times 0.50$	=		£2,000
Expected value		$£22,500 + £2,000$	=		£24,500
Less cost					<u>£6,000</u>
Net benefit					£18,500

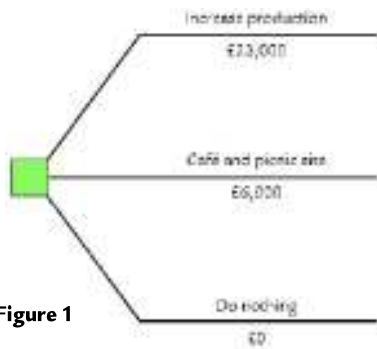


Figure 1

a decision tree is unlikely to be used in these circumstances. Other decisions are more strategic, may require a heavier investment and could be more risky. In these situations, a decision tree may be used to try to ensure that the right decision is made. Takeovers, relocating, entering a new market or investing in a new product are all types of decision where a decision tree could be used. These decisions are not easy to make and, even by using decision trees, the risk is not eliminated. However, the risk might be reduced.

A worked example

Hugh and Tom are brothers who operate a farm in Tyneside. Originally, it consisted of a dairy farm, sheep, cereal crops and 130 acres of woodland. In 2001, they hit hard times, as their business was crippled by the outbreak of foot-and-mouth disease. Tom had a hunch that there was a market for locally produced quality products and suggested they should launch their own brand of ice cream. Selling their sheep to buy the necessary equipment, they successfully ventured into the ice cream market.

Their unusual products were a big hit with local restaurants: one restaurant served their balsamic vinegar ice cream with strawberries, while another offered the tomato sorbet as an accompaniment to a main course. In 2004, Hugh was proud to report that, 'we now make more money from this than we ever did from our sheep'.

Hugh believes there is a future in ice cream and that they should aim to increase production and broaden their distribution coverage. Tom, however, thinks they should reduce the channel of distribution and sell directly to the public via a small café and picnic area in their own woodlands.

Table 1 outlines how Tom and Hugh could use decision trees to help with this decision.

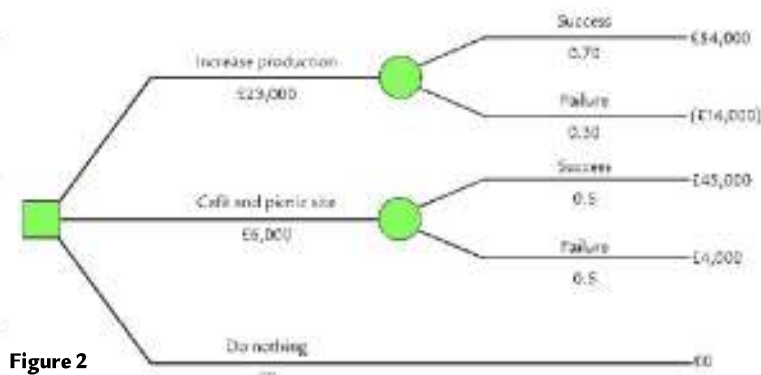


Figure 2

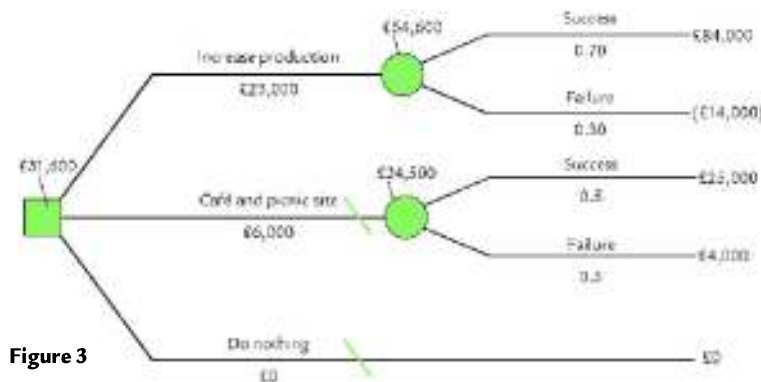


Figure 3

Drawing the decision tree

• **Step 1** — decision trees should always be drawn from left to right and should start with a square to indicate that a decision needs to be made. Draw a line for each of the options, and remember that doing nothing is also an option. Each option should be labelled above the line and the related cost shown below the line (see Figure 1).

• **Step 2** — show the possible outcomes for each option by adding a chance node and lines. The lines should be labelled with the outcome above the line, probability below the line and financial outcome at the end of the line (see Figure 2).

The calculations

Calculations should be worked from right to left. To calculate the expected value of each option, multiply the probability of each outcome by the financial worth and add these together. This is the figure that goes in the circle (see Figure 3). Table 2 shows the worked calculations. Then deduct costs to allow a quantitative decision to be made.

Making the decision

Looking at the decision trees, the net benefit of increasing production is

clearly greater than that of the café and picnic site. Based on quantitative factors alone, the decision should be to increase production. However, it is also important to consider qualitative factors. These could include the personal preference of the farmers (for example, the café might offer employment to other members of the family), the source and accuracy of the predictions and the availability of capital. Increasing production requires a much higher initial investment than setting up a café, and Tom and Hugh would have to consider whether they could fund this.

Summary

Decision trees enable managers to quantify the options open to them and calculate the best option on financial grounds. This can help reduce the risk of such a decision, although the value of the technique will depend on the underlying data and the importance of non-financial factors.

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