

# Risk Management and Decision Tree

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# Risk Management and Decision Tree

## Risk Vs Uncertainty

- ▶ **Risk** is where there are a number of possible outcomes and the probability of each outcome is known.

For example, based on past experience of digging for oil in a particular area, an oil company may estimate that they have a 60% chance of finding oil and a 40% chance of not finding oil.

- ▶ **Uncertainty** occurs when there are a number of possible outcomes but the probability of each outcome is not known.

For example, the same oil company may dig for oil in a previously unexplored area. The company knows that it is possible for them to either find or not find oil, but it does not know the probabilities of each of these outcomes.

- ▶ Ex. Bad health condition is a risk, premature death is a uncertainty.

## Downside risk and uncertainty

- ▶ Risk can be applied to a situation where there are several possible outcomes and, on the basis of past relevant experience, probabilities can be assigned to the various outcomes that could prevail.
- ▶ Uncertainty can be applied to a situation where there are several possible outcomes but there is little past relevant experience to enable the probability of the possible outcomes to be predicted. There are a wide range of techniques for incorporating risk into project appraisal.
- ▶ Sensitivity analysis assesses how responsive the project's NPV is to changes in the variables used to calculate that NPV. One particular approach to sensitivity analysis, the certainty-equivalent approach, involves the conversion of the expected cash flows of the project to riskless equivalent amounts.
- ▶ A probability analysis of expected cash flows can often be estimated and used both to calculate an expected NPV and to measure risk. Other risk adjustment techniques include the use of simulation models, discounted payback and risk-adjusted discount rates.
- ▶ *Downside risk refers to the risk that an adverse or negative outcome may occur.*

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## Risk preference

1. A **risk seeker** is a decision maker who is interested in the best outcomes no matter how small the chance that they may occur.
2. A decision maker is **risk neutral** if they are concerned with what will be the most likely outcome.
3. A **risk averse** decision maker acts on the assumption that the worst outcome might occur.

This has clear implications for managers and organizations.

A risk seeking manager working for an organization that is characteristically taking the risk for a rapid growth, risk averse is likely to make decisions that are not congruent with the goals of the organization. There may be a role for the management accountant here, who could be instructed to present decision-making information in such a way as to ensure that the manager considers all *the possibilities, including the worst.*

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## Risk Management Process

- ▶ Risk management is process of understanding and managing the risk that the entity is inevitably subject to in attempting to achieve its corporate objectives.
- ▶ Risk management can benefit an organization. Risk can not be eliminated however it can be controlled.
- ▶ The risk management approach taken by an organization depends on **risk appetite, attitude and capacity.**
  - ▶ Risk appetite is the nature and strengths of risk that an organization is willing to accept.
  - ▶ Risk attitude is the directors' views on the level of risk that they consider desirable.
  - ▶ Risk capacity describes the maximum amount of risk the organization can bear.

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## Risk Vs Return

- ▶ Organisations may be willing to tolerate a higher level of risk if they receive a higher level of return . A willingness to take certain risks in order to seize new opportunities can be essential for success. In a commercial organisation the shareholders who themselves ultimately bear the risk of a business may welcome some risk-taking. Under this view a business should:
  - ▶ Reduce risk where possible and necessary, but not eliminate all risks
  - ▶ Maximise the returns that are possible given the levels of risk
- ▶ Not-for-profit organizations will also weigh up risk and return, though the risks and rewards are less likely to be financial. For example, a charity might weigh the risk of injury to staff from sending aid into war zones against the beneficiaries' need for help.

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## Expected Value

- ▶ An expected value is a weighted average of all possible outcomes. It calculates the average return that will be made if a decision is repeated again and again.
- ▶ In other words it is obtained by multiplying the value of each possible outcome (n) by the probability of that outcome (p), and summing the results.

$$EV = \sum pn$$

## Pros and Cons of EV

### Advantages

Takes uncertainty into account by considering the probability of each possible outcome and using this information to calculate an expected value.

The information is reduced to a single number resulting in easier decisions.

Calculations are relatively simple.

### Disadvantages

The probabilities used are usually very subjective since it is estimates.

The EV is not useful for one-off decision as the probabilities are long term averages.

The EV does not consider the risk appetite of the people involved with decision making.

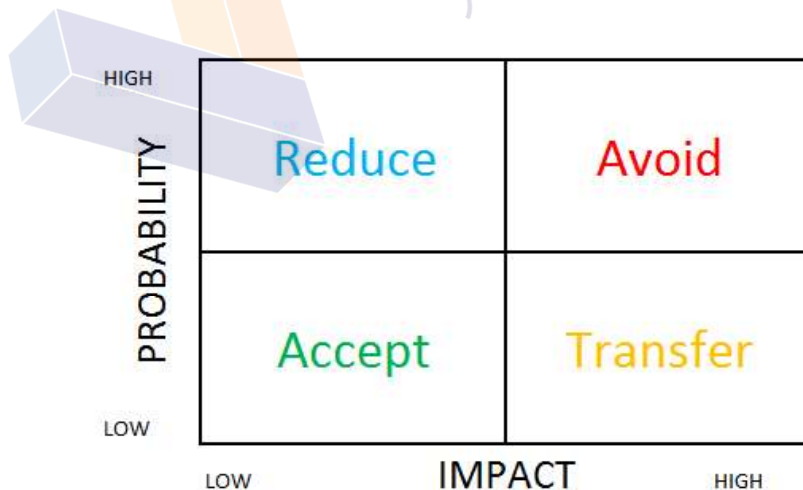
The EV may not correspond to any of the actual possible outcomes.

## Perfect and imperfect information

- ▶ The value of **perfect information** is the difference between the **expected value of profit with perfect information** and the **expected value of profit without perfect information**. Imperfect information is better than no information at all but could be wrong in its prediction of the future.
- ▶ **Perfect information** removes all doubt and uncertainty from a decision, and enables managers to make decisions with complete confidence that they have selected the optimum course of action.

## TARA Model

- ▶ The TARA framework outlines the approach that can be taken with risks: transfer, avoidance, reduction or acceptance.



## TARA Model

- ▶ **Risk transfer** - Risks can be transferred - to other internal departments or externally to suppliers, customers or insurers. Risk transfer can even be to the state. This can take the form of insurance, getting customers to sign waivers, having suppliers take on liability or the state taking responsibility for example in the case of a natural disaster.
- ▶ **Risk sharing** - Risks can be partly held and partly transferred to someone else. An example is an insurance policy, where the insurer pays any losses incurred by the policyholder above a set amount. Risk-sharing arrangements can be very significant in business strategy. For example in a joint venture arrangement each participant's risk can be limited to what it is prepared to bear.
- ▶ **Risk avoidance** - A company may deal with risk by abandoning operations in a particularly high risk area, for example operations in politically volatile countries where the risks of loss (including loss of life) are considered to be too great or the costs of security are considered to be too high.
- ▶ **4.3 Risk reduction** - Often risks can be controlled or reduced, but not avoided altogether. This is true of many business risks, where the risks of launching new products can be reduced by market research, advertising and so on. Many businesses undertake **hazardous activities where there is a risk of injury** or loss of life (for example in a factory or on a farm). These risks cannot be avoided completely. However, they have to be **reduced to an acceptable level by** incurring the costs of risk mitigation - installing protective shielding, issuing safety equipment like hats or protective glasses.

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## Value of Perfect Information

In [decision theory](#), the **expected value of perfect information (EVPI)** is the price that one would be willing to pay in order to gain access to [perfect information](#).

$$EPVI = EVPP - EVUU$$

EVPP - Expected value of perfect prediction

EVUU - Expected Value under Uncertainty

A complication that arises with [decision trees](#) is that they allow you to calculate the value of having further information, say about market conditions, which in turn allows you to decide whether or not it is worth paying for market research.

**Step 1: Calculate the expected value**

**Step 2 : Select the highest expected value**

**Step 3: Sum up the highest expected value of each uncertainty levels.**

**Step 4 : Deduct the value of step 2 from step 3.**

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# Decision Tree

- ▶ **Decision trees** are diagrams which illustrate the choices and possible outcomes of a decision.
- ▶ Rollback analysis evaluates the EV of each decision option. You have to work from right to left and calculate EVs at each outcome point.
- ▶ A decision tree is a pictorial method of showing a sequence of interrelated decisions and their expected outcomes. Decision trees can incorporate both the probabilities and values of expected outcomes, and are used in decision making.

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## How draw a decision tree

- ▶ **Step 1:** Draw the tree from *left to right*, showing appropriate decisions and events / outcomes. Some common symbols can be used:
  - ▶ The square is the decision point.
  - ▶ The circle will be used as the symbol for an outcome point.
  - ▶ The lines will be used to reflect the alternatives.
  - ▶ Label the tree and relevant cash inflows/outflows and probabilities associated with outcomes.
- ▶ **Step 2:** Evaluate the tree from *right to left* carrying out these two actions:
  - ▶ (a) Calculate an expected value (EV) at each outcome point.
  - ▶ (b) Choose the best option at each decision point.
- ▶ **Step 3:** Recommend a course of action to management.

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## The certainty-equivalent approach

- ▶ Another method is the certainty-equivalent approach. By this method, the expected cash flows of the project are converted to riskless equivalent amounts. The greater the risk of an expected cash flow, the smaller the certainty-equivalent value for receipts, or the larger the certainty-equivalent value for payments.
- ▶ As the cash flows are reduced to supposedly certain amounts, they should be discounted at a risk-free rate. The risk-free rate is effectively the level of return that can be obtained from undertaking no risk.

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## Risk Adjusted Discount Rate

- ▶ Investors want higher returns for higher-risk investments. The greater the risk attached to future returns, the greater the risk premium required. Investors also prefer cash now to later and require a higher return for longer time periods.
- ▶ In investment appraisal, a risk-adjusted discount rate can be used for particular types or risk classes of investment projects to reflect their relative risks.
- ▶ For example, a high discount rate can be used so that a cash flow which occurs quite some time in the future will have less effect on the decision. Alternatively, with the launch of a new product, a higher initial risk premium may be used with a decrease in the discount rate as the product becomes established.

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