TRINITY UNIVERSITY OF ASIA

TUA Learning Cloud

CHAPTER 7: DECISION THEORY

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3MKTG02

OUTLINE

- ✓ *The Decision Process and Causes of Poor Decisions*
- ✓ Decision Environments
- ✓ Decision Making Under Certainty
- ✓ Decision Making Under Uncertainty
- ✓ Decision Making Under Risk
- ✓ Decision Trees
- ✓ Expected Value of Perfect Information
- ✓ Sensitivity Analysis

LEARNING OBJECTIVES

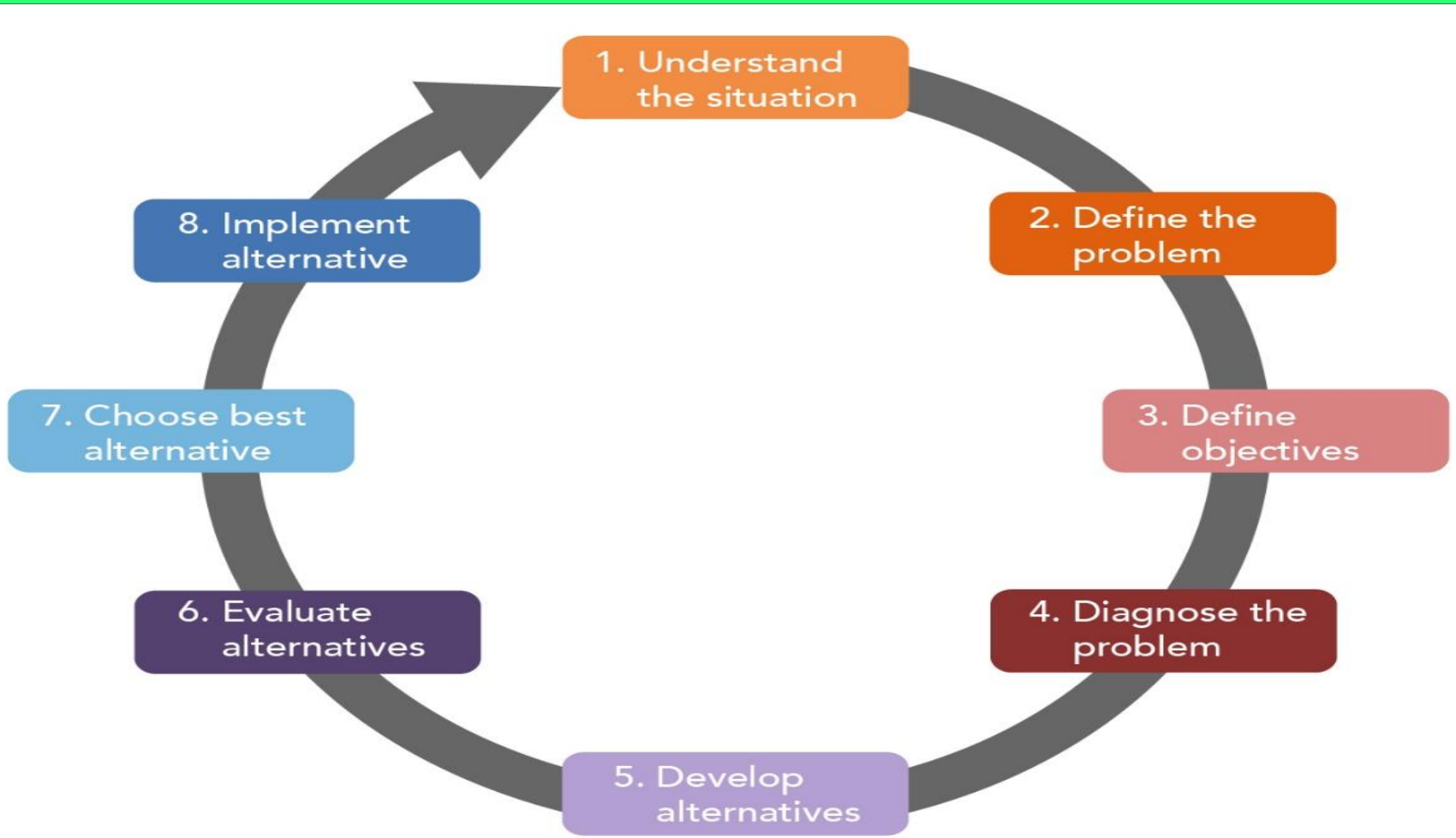
When you complete this chapter, you should be able to:

- ☑ **Outline the steps in Decision Making**
- ☑ **Name some causes of poor decisions**
- ☑ **Describe the techniques that apply to decision making under certainty and uncertainty**
- ☑ **Construct a decision tree and use it to analyze a problem**
- ☑ **Compute the expected value of perfect information**
- ☑ **Conduct sensitivity analysis on a simple decision problem**

DECISION THEORY

- A process of selecting an act out of several available alternative courses of action judged to be the best action according to some predetermined criteria.
- The main aim of decision theory is to help the decision-maker in selecting best course of action from amongst the available course of action.

THE STEPS IN DECISION MAKING



CAUSES OF SOME POOR DECISIONS

CAUSES OF SOME POOR DECISIONS

- Waiting too long for others' input.
- Failing to get the right input at the right time.
- Failing to understand input because of insufficient skills.
- Failing to understand when something that worked in the past will not work now.
- Failing to know when to make a decision without all the right information and when to wait for more advice.

DECISION ENVIRONMENTS

- **DECISION MAKING UNDER UNCERTAINTY**

✓ *Complete uncertainty as to which state of nature may occur*

- **DECISION MAKING UNDER RISK**

✓ *Several states of nature may occur*

✓ *Each has a probability of occurring*

- **DECISION MAKING UNDER CERTAINTY**

✓ *State of nature is known*

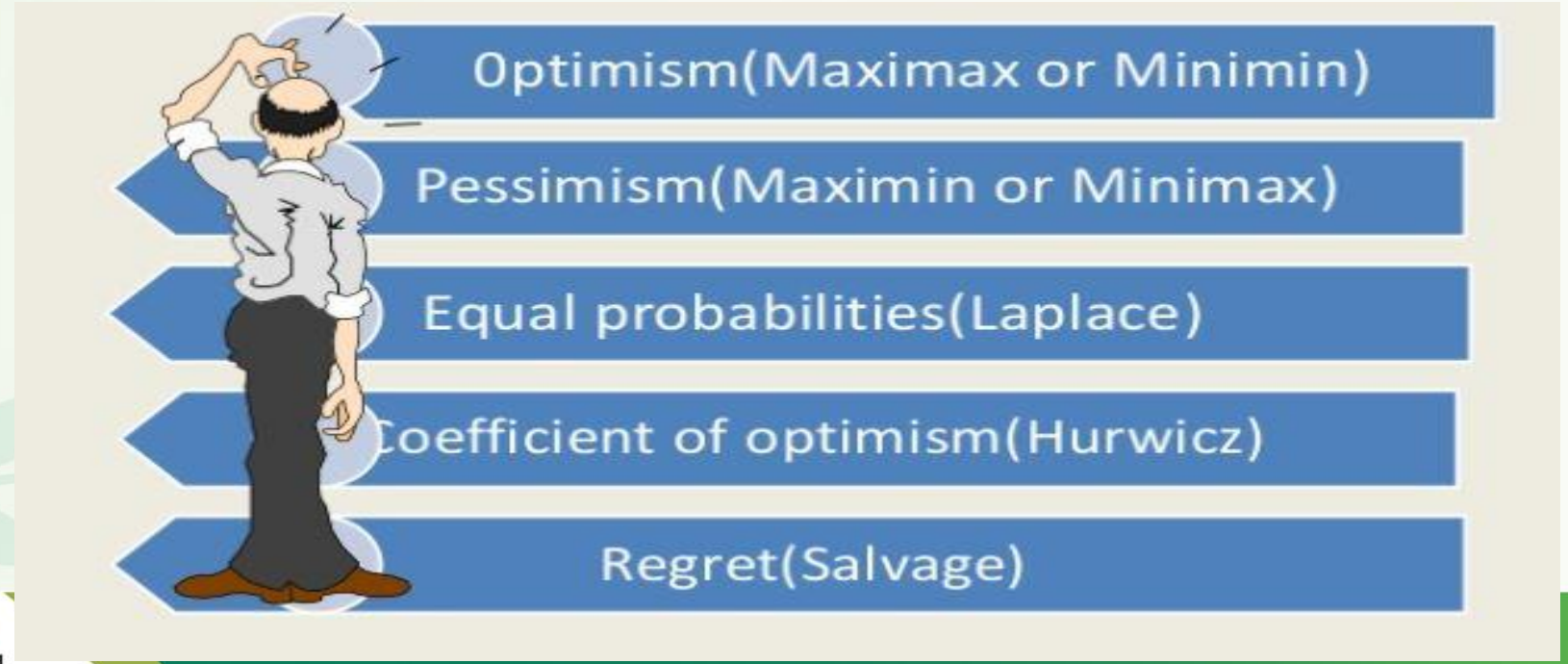
DECISION MAKING UNDER CERTAINTY

- Environment in which relevant parameters have known values
- Typical for structured problem with short time horizon
- There is only one time of event that can take place
- Its very difficult to find complete certainty in most of the business decisions
- In many routine type of decision , almost complete certainty can be noticed.
- In uncertainty the decision are of very little significance to the success of business

DECISION MAKING UNDER UNCERTAINTY

- Cannot list all possible outcomes
- Cannot assign probabilities to the outcomes

❖**CRITERIA OF DECISION MAKING UNDER UNCERTAITY**



DECISION MAKING UNDER UNCERTAINTY

➢ OPTIMISM (MAXIMAX OR MINIMIN CRITERION)

- Choose the alternative with the best possible payoff
- Locate the maximum or minimum payoff values corresponding to each alternatives
- The maximax s 7000, hence the company should adopt strategy S1

Strategies	States of nature N1	N2	N3	ROW MAXIMUM
S1	7000	3000	1500	7000
S2	5000	4500	0	5000
S3	3000	3000	3000	3000

DECISION MAKING UNDER UNCERTAINTY

➢ PESSIMISM (MAXIMIN OR MINIMAX CRITERION)

- Choose the alternative with the best of the worst possible payoffs
- Locate the minimum payoff values corresponding to each alternatives
- The act/decision with higher minimum value is 3000, hence the company should adopt S3

Strategies	States of nature N1	N2	N3	Row Minimum
S1	7000	3000	1500	3000
S2	5000	4500	0	0
S3	3000	3000	3000	3000

DECISION MAKING UNDER UNCERTAINTY

➢ LAPLACE CRITERION (EQUAL PROBABILITIES)

- Under this assumption, all states of nature are equally likely.
- Decision maker can compute the average payoff for each row (the sum of the possible consequences of each alternative is divided by the number of states of nature) and then, select the alternative that has the highest row average.

Strategies	States of nature N1	N2	N3	ROW MAXIMUM
S1	7000	3000	1500	3,833.33
S2	5000	4500	0	3166.66
S3	3000	3000	3000	3000

The largest expected return is from Strategy S1, THE EXECUTIVE MUST SELECT S1

DECISION MAKING UNDER UNCERTAINTY

❖COEFFICIENT OF OPTIMISM (HURWICZ)

- This criterion represents a compromise between the optimistic and the pessimistic approach to decision making under uncertainty.
- For each alternative select the largest and lowest payoff values and multiply these with α and (1- α) values respectively.
- Then calculate the weighted average using the formula:

H Coefficient of optimism =

α(maximum in column)+(1+α)(minimum in column)

- Select the best answer.

DECISION MAKING UNDER UNCERTAINTY

Strategy	Maximum pay-off	Minimum pay-off	H
S1	7000	1500	4800
S2	5000	0	3000
S3	3000	3000	3000

Assuming degree of optimisim $\alpha = 0.6$ and $(1- \alpha)=0.4$

H Coefficient of optimism = α (maximum in column) + $(1-\alpha)$(minimum in column)

The maximum value is 4800, adopt S1

DECISION MAKING UNDER UNCERTAINTY

❖REGRET(SALVAGE RULE)

- This rule represents a pessimistic approach.
- The opportunity loss reflects the difference between each payoff and the best possible payoff in a column (it can be defined as the amount of profit forgone by not choosing the best alternative for each state of nature).
- For each course of action identify the maximum regret value, record this no in a row
- Select the course of action with Smallest anticipated opportunity loss value

DECISION MAKING UNDER UNCERTAINTY

Strategies	States of nature		
	N1	N2	N3
S1	7000	3000	1500
S2	5000	4500	0
S3	3000	3000	3000
Column max	7000	4500	3000

Strategies	N1	N2	N3	
S1	7000 – 7000 = 0	4500-3000= 1500	3000-1500=1500	1500
S2	7000- 5000 = 2000	4500-4500=0	3000-0=3000	3000
S3	7000-3000 = 4000	4500-3000= 1500	3000-3000=0	4000
Col max	7000	4500	3000	

The company should adopt minimum opportunity loss strategy S1

DECISION MAKING UNDER RISK

- Must make a decision for which the outcome is not known with certainty
- Can list all possible outcomes & assign probabilities to the outcomes

DECISION TREES

- Decision tree is a network which exhibits graphically the relationship between the different parts of the complex decision process.
- It is a graphical model of each combination of various acts and states of nature along with their payoffs, probability decision
- It is extremely useful in multistage situations, which involve a number of decisions, each depending on the preceding one.
- A decision tree analysis involves the construction of diagram that shows, at a glance, when decisions are expected to be made-in what sequence, their possible outcomes & corresponding payoffs.

DECISION TREES

- A DT consists of nodes, branches, probability estimates and payoffs
- Three types of “nodes”

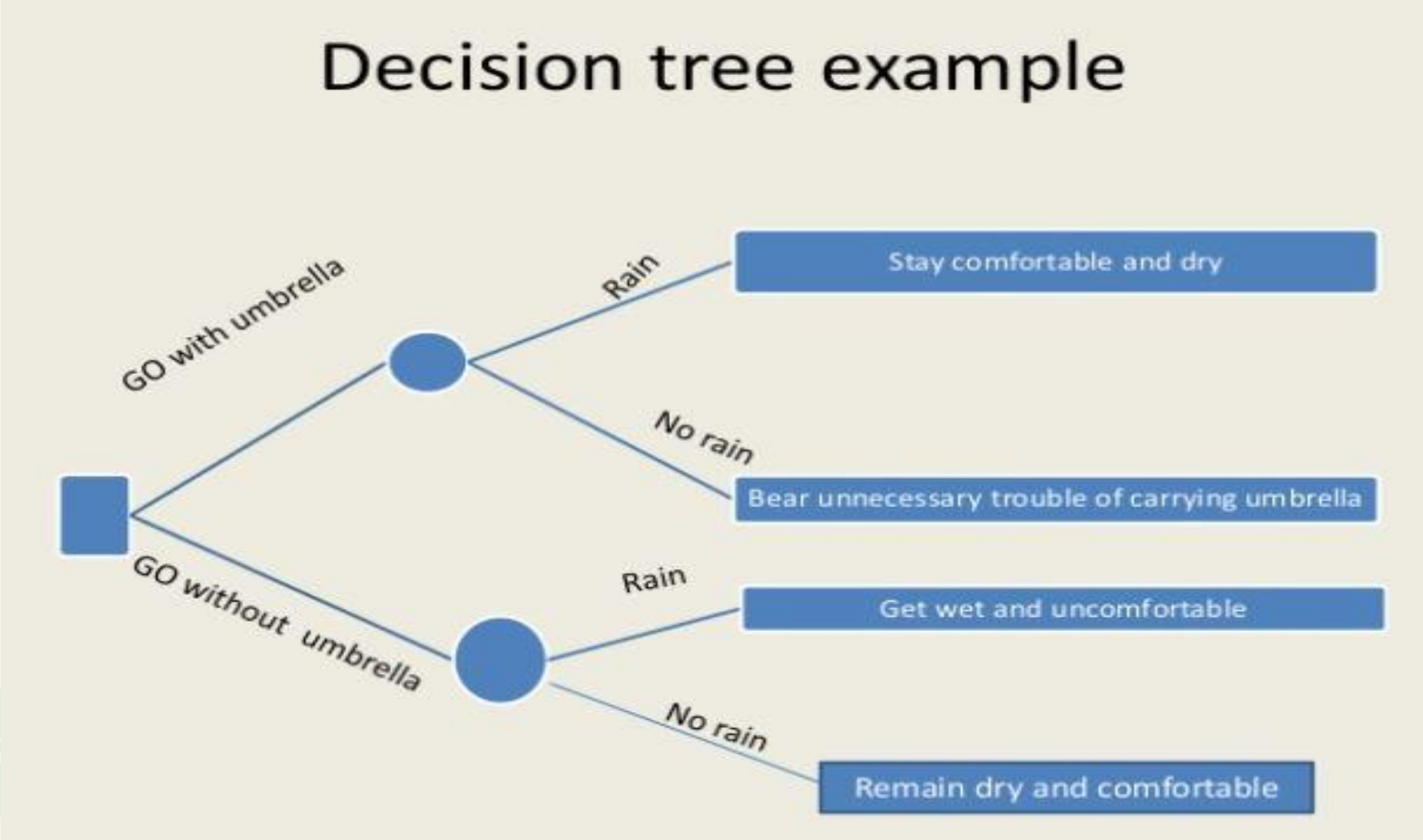
-Decision nodes-represented by squares () It represents a point of action where a decision maker must select one alternative course of action among the available

-Chance nodes- represented by circles () it indicates a point of time where the decision maker will discover the response to his decision

-terminal nodes- represented by triangles (optional)

- Solving the tree involves pruning all but the best decisions at decision nodes, and finding expected values of all possible states of nature at chance nodes
- Create the tree from left to right
- Solve the tree from right to left

DECISION TREES



EXPECTED VALUE OF PERFECT INFORMATION

EXPECTED VALUE OF PERFECT INFORMATION: The difference between the expected payoff under certainty and the expected payoff under risk

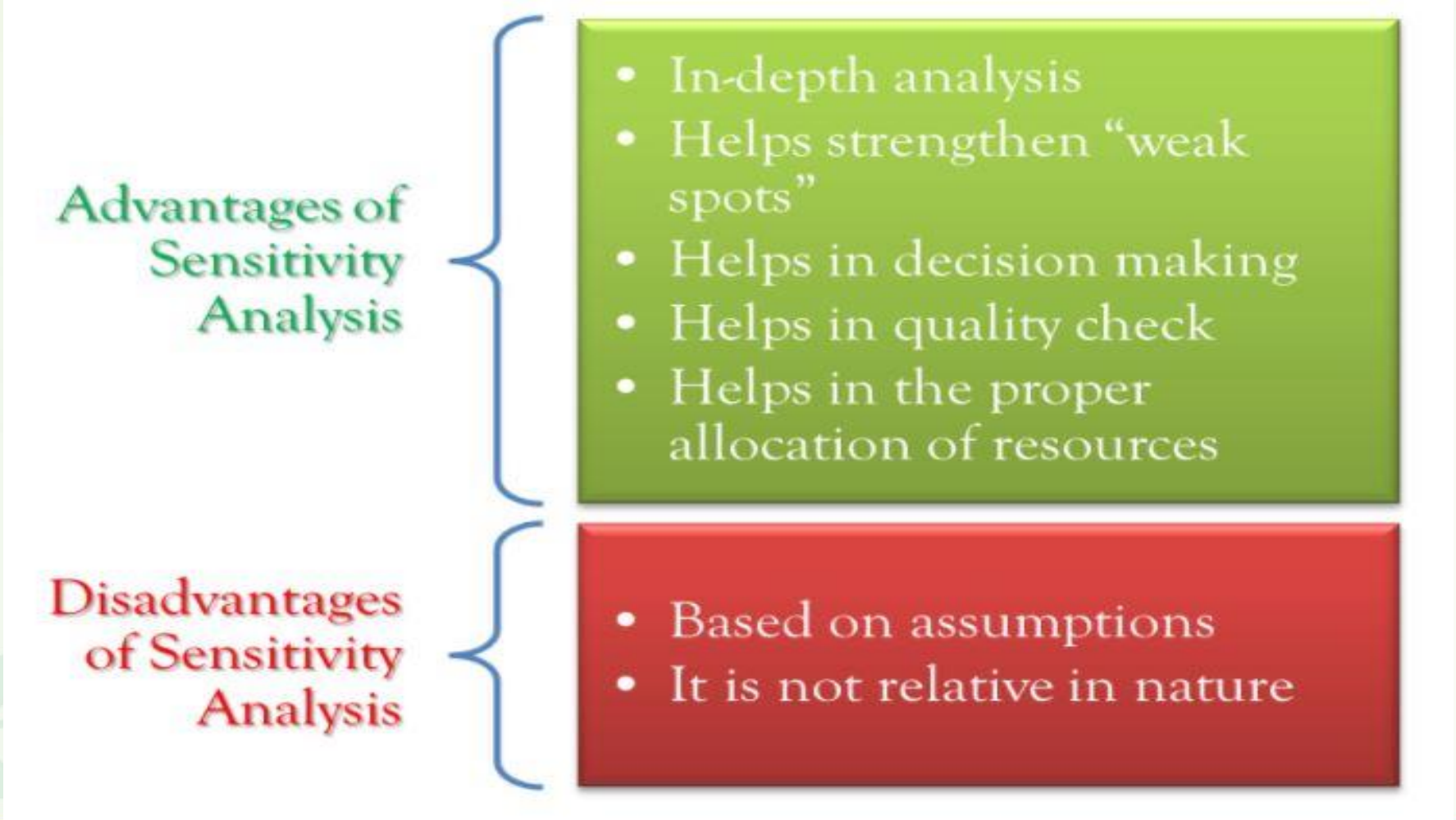
Expected value of perfect information = Expected payoff under certainty - Expected payoff under risk

EVPI is defined as the maximum amount one would pay to obtain perfect information about the state of nature that would occur

SENSITIVITY ANALYSIS

- Sensitivity analysis is a management tool that helps in determining how different values of an independent variable can affect a particular dependent variable
- As sensitivity analysis studies each variable independently, it can identify critical variables that may act as a weakness.
- Through sensitivity analysis, the management can know which variables have a high impact on success or failure of a project.

SENSITIVITY ANALYSIS



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Thank You!