Decision Making Environments and Decision Criteria

In business, a wide variety of decisions are encountered. The analytical approach will depend largely on the decision environment: certainty and uncertainty

Decision-Making Environments

Certainty is a decision environment in which the results of each alternative are known before the decision is made.

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Let's consider Econoprint Company, which makes replacement cartridges for printers. A sales representative made a negotiation with a distributor for 1 million cartridges at P250 each. The distributor wants the cartridges packed by 6 rather than by 24 per package. The sales rep urges the national sales manager a quick decision to avoid losing the distributor. The table below shows the projected profits for the products packed in 6.

Because all costs and revenues are known for each alternative, the decision is straightforward. What is the national sales manager?

*Uncertainty* is a decision environment in which the decision maker does not know what outcome will occur when an alternative is selected.

An example for this is when you make a decision whether to buy a land outside Baguio City with the hope that you will soon resell the property.  If you will buy, the net change in your financial position is zero. If you choose to buy, you will make P10,000,000 or P20,000,000 or you will lose P5,000,000? Identifying the possible outcome is difficult in a competitive real state market. You must decide to buy in an environment of uncertainty.

To decide which among alternatives are we going to choose, we'll establish decision criteria.

*Types of Decision Criteria*

*1. Non-probabilistic Decision Criteria*are used when probabilities associated with payoffs are unknown*.*

   a.  In the *Maximax*criterion*,*the decision maker finds the maximum possible payoff and then selects the option with the greatest maximum payoff. Usually, the decision maker who opts to use this criterion is an optimistic one.

    Maximum gain is $200,000. The corresponding decision is to build a large plant.

   b. In the *Maximin* criterion, the decision maker finds the minimum possible payoff and selects the option with the greatest minimum payoff.   This also called a pessimistic (conservative) criterion.

The maximum in the minimum row is $0, thus, the corresponding decision is to do nothing.

   c. In the *equally likely (Laplace)* criterion, the decision maker assumes that the outcomes are equally likely to occur.

The maximum average is $40,000, thus the decision is to build a small plant.

   d. In the *Hurwicz* criterion, the decision maker simultaneously take into account the best and the worst possible outcomes, by articulating a "coefficient of optimism" or coefficient of realism, α, that determines the emphasis on the best end.

The maximum weighted value is $124,000, thus, build a large plant.

   e. *Minimax Regret* considers the results of selecting the "wrong" alternative. The decision maker minimizes the maximum regret associated with each alternative. The following steps are carried out.

       Step 1. construct the opportunity loss or regret table

*Opportunity loss or regret* = optimal payoff - actual payoff (for the same state of nature)

       Step 2. Find the maximum regret for each alternative.

       Step 3. Select the minimum of the maximum regret values.

The minimum regret is $100,000, thus the decision is to build a small plant.

*2. Probabilistic Decision Criteria*incorporates the decision maker's assessment of the probability of each state of nature occurring.

     1. *Expected-value criterion*employs probability to select the alternative that will produce the greatest average payoff (maximization of expected reward) or minimum average loss (minimization of expected regret.

Use the following steps:

a.  Define the decision alternatives

b Define the possible outcomes (states of nature) associated with each alternative.

c. Assign probabilities to the possible outcomes associated with each alternative.

d. Compute the expected value for each decision alternative.

 Using the *maximization of expected reward*. We consider the following:

*Expected reward (Q)*or *expected monetary value* is the probability weighted sum of possible rewards for each alternative.

Q(actionA)=(rewardof1ststateofnature)⋅(probabilityof1ststateofnature)+(rewardof2ndstateofnature)⋅(probabilityof2ndstateofnature)+...+(rewardoflaststateofnature)⋅(probabilityoflaststateofnature)

This requires a reward table with conditional rewards and probability assessments for all the states of nature.

The alternative that gives the greatest Q is the chosen decision.

The greatest expected monetary value of $40,000 is given by deciding to make a small plant.

It may be possible to purchase additional information about future events and thus make a better decision. What is the *expected value of the perfect information (EVPI)*?  If  information was available that perfectly predicted which state of nature was going to occur, the best decision can be made.  We have to determine the expected value with the perfect information (EV with PI), the expected or average return if we have perfect information before a decision has to be made.

*EVPI (expected value of the perfect information) Computation*

*Perfect Information (PI)* changes environment from making decision under risk to decision making with certainty.

Even though the perfect information enables the decision maker to make the correct decision, the states of nature occurs only a portion of the time.

So we need to determine *EV with PI ( expected value with perfect information), t*he expected or average return if we have perfect information before a decision has to be made.

EVwithPI=(bestrewardfor1ststateofnature)⋅(probabilityof1ststateofnature)+(bestrewardfor2ndstateofnature)⋅(probabilityof2ndstateofnature)+...+(bestrewardforlaststateofnature)⋅(probabilityoflaststateofnature)

EVwithPI=(200,000⋅0.5)+(0⋅0.5)=100,000

The expected value of building a small plant with the perfect information is $100,000.

"The*EVPI* is the maximum amount a decision maker would pay for additional information resulting in a  decision better than one without perfect information"

EVPI is the expected outcome with perfect information minus the expected outcome without perfect information.

EVPI=EVwithPI−Q

Thus, EVPI=100,000−40,000=60,000.

What will be your decision? Are you going to buy the perfect information to have a better decision? Why or why not?

An alternative approach to maximize EMV is to minimize expected opportunity loss.