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**PMEducation**

DECISION TREE

**WHAT IT IS**

The Decision Tree Analysis is a technique used to select between alternatives, by showing the expected outcomes of selected inputs. Drawn as a tree with branches, in logic flow structure, decisions are illustrated with possible consequences that lead you to a best outcome.

In Risk Management, the Decision Tree allows the input of several Risk alternatives and calculates the impact on a project goal (such as Cost or Time). In this way an optimum decision can be made which minimizes the overall Risk.

This tool is widely used in Quantifying the Risks and in Planning Risk Responses.

**HOW IT WORKS**

As an example we will use a scenario that often occurs in Project Management, which contractor to choose. We are given the bid prices of 2 contractors. We also know the lost benefit of a late completion is $30,000 per month.

1. Begin with the outcome. For our example “Which Contractor to Use”. Place this on the diagram in a box on the left. We draw the diagram from left to right.
2. Add a small “decision node” box to the right of “Which Contractor to Use”. This node reminds us that we will be making a decision.
3. Draw a branch from the decision node to each of the available alternatives. In our example there are two: the Low Bidder who is risky, and the Reliable High Bidder.
4. Insert the bid price next to the Bidder. The Low Bidder’s price is $110,000, and the High Bidder’s price is $140,000.
5. Then add a small “chance node” circle to the right of each bidder. This node indicates a probability branch.
6. Branching out from the chance node, show the likely “lateness” for each bidder. In our example, we think the Low Bidder could finish 3 months late, or on time. Other branches could be shown for one and two months late. We think the High Bidder would not likely finish more than one month late, and could finish on time.
7. Indicate the value of each lateness. At $30,000 per month, a three month lateness represents a lost benefit of ($30,000 x 3=) $90,000. On time completion has zero lost benefit.
8. To the right of each “lateness” place the probability of the happening. For example, we think the Low Bidder has a 50% chance of being 3 months late and a 50% chance of finishing on time. Likewise the High Bidder has a 10% chance of finishing one month late and a 90% chance of finishing on time. REMEMBER: the chances must add up to 100%.
9. Now we begin to calculate. For the Low Bidder, the cost of Risk is:

(50% x $90,000) + (50% x 0) = $45,000.

Added to the contract bid of $110,000, the total bid and risk cost is $155,000.

For the High Cost Bidder, the cost of Risk is:

(10% x $30,000) + (90% x 0) = $3,000

Added to the contract bid of $140,000, the total bid and risk cost

Is $143,000. So this is the lower overall price alternative, and the

one we will select.

1. Finally, we will look for worst case scenarios, by calculating the Path Values. Path Values are the sums of every cost on a path. For the Low Bidder and 3 months late, the Path Value is: $110,000 + $90,000 = $200,000. The other 3 Path values are listed on the far right. Not surprisingly, the worst case is with the Low Bidder being 3 months late. While it seems intuitive for our example, this step has merit in more complex examples.
2. The best case scenario is the Low Bidder with on-time delivery. Unfortunately, in our example that is just not most likely to happen!

**KEY ELEMENTS**

For this method to be effective, the following key elements must be used:

* Identified list of Alternatives and accurate Costs
* Probabilities of outcomes
* Agreement on the use of this tool for decision making
* Software for many alternatives and complex projects.
* Careful structuring of the Decision Tree, including all possible alternatives.

ADVANTAGES and DISADVANTAGES

Of DECISION TREE

ADVANTAGES

* Highly visual. Easy to see and to explain to others
* Identifies relationships between alternatives and outcomes
* Brings Risk and Probability into organization’s decision making
* Easy to make-by-hand for simple projects

DISADVANTAGES

* Diagram can take a lot of space.
* Probabilities can be difficult to determine. Best guess is often used which could introduce personal biases.
* Needs to be re-calculated whenever a major change occurs.
* Requires software for complex projects.
* Team/ Sponsor needs to agree to accept this tool’s output.

FINAL NOTE: This tool is useful for Quantifying project Risks. It can also be used to make other decisions such as optimum investment, best-buy, and so on.

The numerical outcome ($143,000 in our example) is sometimes called Expected Monetary Value (EMV). This calculation can be used, even when no decision is required, by multiplying costs (or benefits) by probabilities.

Below you will find the Decision Tree Diagram for “Which Contractor to Use”.

