



## Decision Analysis

Success or failure of any undertaking mainly lies with the decisions made in every step of the undertaking. When it comes to business the main goal would be to maximize shareholders stake and attain maximum profitability. Therefore, it's judicious to employ the best practices in decision making to arrive at the most practicable solution to a problem. (P.C & Jhunjhnuwala, 2010) Decision theory comes in as a discipline with a set of methods that assist decision makers to arrive at the best cause of action every problem has a these five main elements: decision maker, goals, situation, alternative cause of action and uneven results from choices.

### **Part 1**

On the case of Thomson Lumber Company, the company is faced with three alternative cause of action one to construct a large plant second construct a small plant or do nothing. All these three alternatives are exposed to two states of nature a favorable market and unfavorable market condition each of this with equal probabilities of occurrence. Calculating the Expected monetary value (EMV) under the two market conditions for each of the three alternatives; calculating a large plant has an EMV of ten thousand dollars, constructing a small plant has an expected monetary value of forty thousand dollars while doing nothing has an Expected monetary value of zero. The decision criteria under Expected monetary value will be to choose the alternative with the highest expected monetary value and in this case the best decision for Thomson Lumber Company will be to construct a small plant because being faced with the two states of nature it yields the highest EMV.

Under Expected value of perfect information (EVPI) Thomson Lumber Company will be looking at the maximum sum expended on obtaining perfect information. With conditions as stated above and upon adding an alternative namely with perfect information under favorable market condition the payoff is two hundred thousand dollars and zero payoff under unfavorable

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market condition with equal probabilities. Expected value of perfect information will be given by Expected monetary value with perfect information which is one hundred thousand dollars less the maximum EMV without perfect information calculated earlier to be forty thousand dollars thus expected value of perfect information is sixty thousand dollars.

The next decision technique under discussion is the expected opportunity loss also known as the expected regret. The approach of this technique is to focus on opportunity loss and the best cause of action will be the one with the least expected opportunity loss. The steps under this technique are; first prepare a payoff table with all alternative course of action, followed by a regret table gotten by subtracting all payoff values of an occurrence from the highest value of the payoff of that particular occurrence (P.C & Jhunjnuwala, 2010). Considering Thomson Lumber company case drawing an opportunity loss table a decision to construct a large plant would cost the company an opportunity loss of ninety thousand dollars, a decision to construct a small plant would cost the company an opportunity loss of sixty thousand dollars while deciding to do nothing would cost the company one hundred thousand dollars. Under this technique a decision to construct a small plant would be the best alternative among all other alternatives. It should be noted that the minimum expected opportunity loss will always be equal to expected value of perfect information

## Part 2

Taking a case scenario given of Dorothy Smith who is faced with three with three alternative to take Tennessee Street, back roads or Expressway under three states of nature; no traffic congestion, mild traffic congestion and severe traffic condition the three states of nature with probabilities of 0.5, 0.33 and 0.167 respectively. Dorothy is faced with a decision on which route to take, using the EMV technique to calculate the expected travel; taking Tennessee street takes

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an expected travel time of twenty five minutes, taking back road takes twenty four minutes and twelve seconds while taking the expressway takes thirty minutes. Therefore under the expected travel time technique taking the back road will be the best route to use because it has the least expected travel time.

On whether Dorothy should buy a radio in order to know which route to take, we will use the expected value of perfect information technique. Here we will consider the least element on each of the three states of nature i.e. no traffic congestion is 15 minutes, mild traffic congestion will take 25 minutes and with severe traffic congestion will take 30 minutes assigning respective probabilities to the three states of nature the expected travel time with perfect information is 20.85 minutes while the expected travel time without information is 24.2. Subtracting the two we find the expected value of perfect information (value of the radio) which is 3.35 minutes this places value on a radio and therefore Dorothy should buy a radio since it will save her 3.35 minutes travel time.

Mr. Lawson is considering investment options between these alternatives; stock market, bonds and Cds faced with two states of nature one a good economy and a poor economy with equal probability. The first task will be to determine the alternative with the highest expected profit and second determine the value of a perfect forecast. The expected monetary value when he invest in stock is thirty thousand dollars, if he opts for bonds the expected monetary value is twenty five thousand dollars while certificates of deposits would yield twenty three thousand dollars. Under the expected monetary value technique investing in stocks would be the best among all alternatives since it has the highest payoff. With perfect information in a good economy Mr. Lawson would invest in stocks, in a poor economy he will go for certificates of deposits both

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with equal probabilities of payoff. Hence, the expected value of perfect information is 51,500 dollars, while the expected value of perfect information is 21,500 dollars.

### Part 3

All through we have considered decision techniques given perfect information, in this part we are going to discuss decision techniques under uncertainty. (Taha, Natarajan, Balasubramanie, & Tamilarasi, 2009) Maximax decision criterion the decision maker picks that state of nature which offers the highest take for a certain strategy. The steps taken are; we prepare a payoff table then we choose the maximum payoff for to each strategy finally from the set of these maximum payoffs we choose the maximum of them and this is the optimal strategy. In illustration used earlier of Thomson Lumber company the set of maximum payoff from the set of alternatives will be (200,000: 100,000 and 0) the maximum payoff among these three is 200,000 which is maximax. This will be interpreted to mean that given market conditions are favorable the best course of action will be to construct a large plant which will make the most of the maximum payoff.

Using the maximin criterion or regret criterion in this case we employ the technique with an aim of curtailing the maximum occasion loss. (P.C & Jhunjnuwala, 2010) The steps taken to arrive at the maximin value are preparing the payoff list, identify the minimum occasion gain from the set of these gains we identify the minimum of them. From the case of Thomson Lumber company the set minimum payoffs is (-180,000, -20,000 and 0) the minimum of these payoff is zero. Hence, under maximin criterion the best decision would be to do nothing.

Hurwicz criterion also known criterion of realism is founded on the argument that a rational decision maker is neither optimistic nor pessimistic on the state of nature affecting the

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set of alternative under consideration. To factor in this this criterion consider the degree of optimism by assigning a coefficient ranging between 0 and 1 to the payoff. Then compute the weighted average payoff for each alternative. The decision criterion under this technique is selecting the alternative with the highest weighted average payoff. Using our example of Thomson Lumber company we will assign 0.8 as our degree of optimism, the alternative to construct a large plant will have a weighted average payoff of 124,000 dollars, constructing a small plant will have a weighted average payoff of 76,000 dollars. Under this technique the optimal decision will be to construct a large plant since the alternative has the highest value of payoff among the three alternatives.

Under Laplace, (Taha, Natarajan, Balasubramanie, & Tamilarasi, 2009) technique all alternative course of action are assigned equal chances of occurrence then the expected monetary value is obtained. The decision criterion under Laplace will be to choose the alternative with the highest expected monetary value. Using Thomson Lumber company case, the set of payoff is (10,000, 40,000 and 0) therefore the best course of action is to construct a small plant since the alternative has the highest expected monetary value.

Minimax regret/ opportunity loss criterion understand that the decision will only realize the opportunity loss after they have taken the wrong course of action therefore this technique tries minimize the regret. After preparing the payoff table the regret elements will be obtained by subtracting all payoff values of each alternative form the highest of them then we identify the maximum loss of each alternative and from these set of minimum regrets we identify the maximum loss. The decision criterion is to select the alternative with the minimum of the maximum losses. From the payoff matrix of Thomson Lumber Company the set of maximum payoff in each Alternative is (180,000, 100,000, 200,000) the minimum among them is 100,000.

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This means that using the minimax regret criterion the best course of action is to construct a small plant.

### **Part 4**

Quantitative method software, is a software tool used to assist in solving quantitative methods problems. Using the module option from the menu bar one can select the nature of problem they wish to solve, and in this case it's Decision Analysis. For instance the problems discussed above under part 1,2 and can be solved using QM for windows. We proceed to select New after setting the software mode to decision analysis and then create a new decision table by defining number of alternatives, number of state of nature and the objectives of the analysis. We proceed to entering the data into the table created, after entering the data to the table we can chose the technique to employ from the window drop down menu and use the particular criterion to identify the best cause of action.

## Works Cited

P.C, T., & Jhunjnuwala, B. (2010). *Business Statistics*. New Delhi: S. Chad.

Taha, H. A., Natarajan, A., Balasubramanie, P., & Tamilarasi, A. (2009). *Operations Research: An Introduction Eighth Edition*. New Delhi: Pearson Prentice Hall.