

## Decision Tree Analysis

The decision tree is looking to answer the question: Should we build a new plant or upgrade the existing one?

Each path determines the **expected monetary value (EMV)** for each choice. In this case, upgrading the plant has a higher EMV of \$46M. Let's break this down so you see how to get the numbers in the figure.

There are multiple steps for each path. I'll walk you through the Build New Plant path first and then Upgrade Plant to get the EMVs for both.

### Path 1: Build New Plant

This will cost \$120M (initial investment). There is a **60% chance** the new plant will generate a **reward of \$200M** with a **strong demand** and a **40% chance** it will generate a **reward of \$90M** with a **weak demand**. To understand the impact of building a new plant, let's calculate the numbers for each probability.

**For strong demand:** Take the reward (\$200M) and subtract the initial investment (\$120M), which looks like this:  $\$200M - \$120M = \$80M$ .

**For weak demand:** Take the reward (\$90M) and subtract the initial investment (\$120M), which looks like this:  $\$90M - \$120M = -\$30M$  (notice this is a negative number).

**Calculate the EMV:** Take the outcome of **strong demand** (\$80M) and multiply it by its probability (.60). Then take the outcome of **weak demand** (-\$30M) and multiply it by its probability (.40) and add them together.

$$\text{EMV} = .60 (\$80M) + .40 (-\$30M) = \$48,000,000 + -\$12,000,000 = \$36M$$

### Path 2: Upgrade Plant

This will be a \$50M investment. There is a **60% chance** the new plant will generate a **reward of \$120M** with a **strong demand** and a **40% chance** it will generate a **reward of \$60M** with a **weak demand**. To understand the impact of upgrading the plant, let's calculate the numbers for each probability.

**For strong demand:** Take the reward (\$120M) and subtract the initial investment (\$50M), which looks like this:  $\$120M - \$50M = \$70M$ .

**For weak demand:** Take the reward (\$60M) and subtract the initial investment (\$50M), which looks like this:  $\$60M - \$50M = \$10M$ .

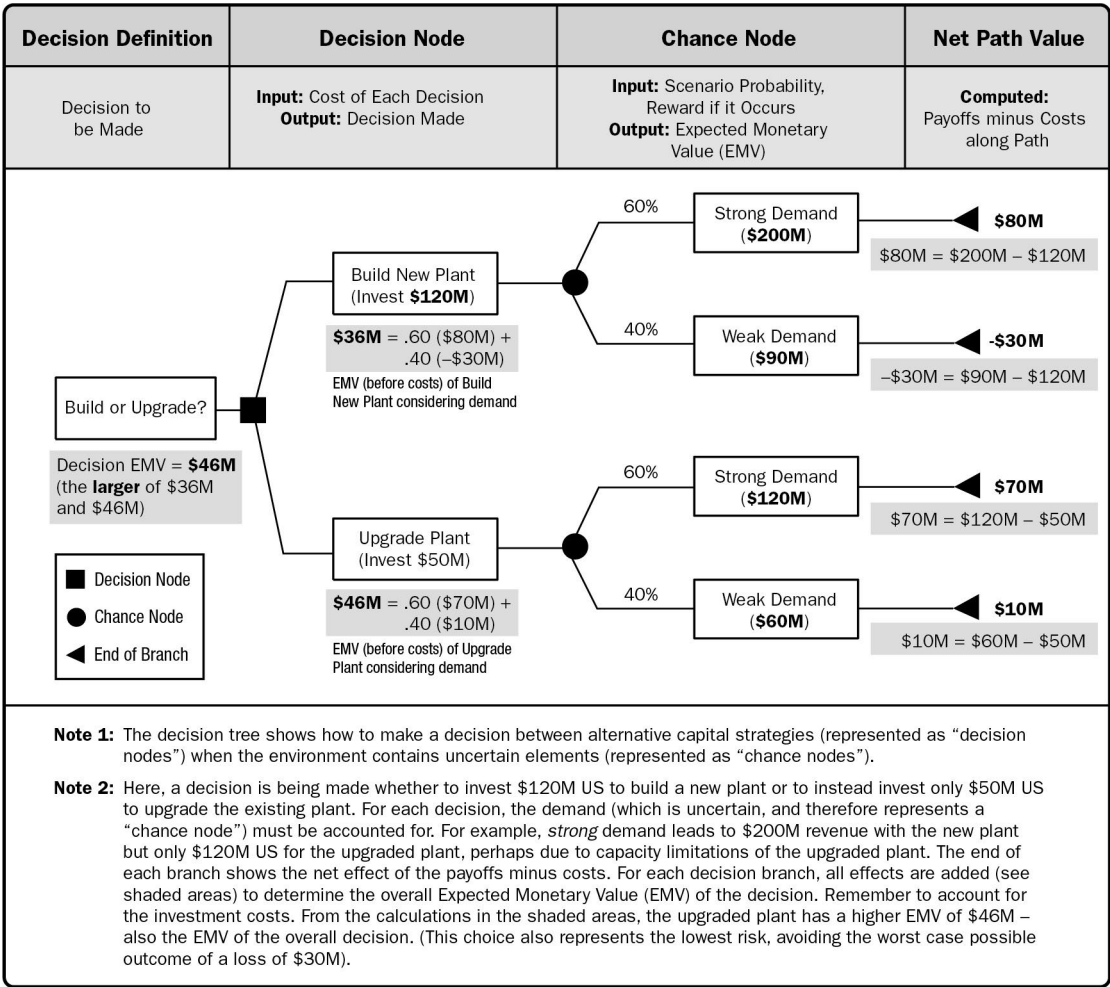
**Calculate the EMV:** Take the outcome of **strong demand** (\$70M) and multiply it by its probability (.60). Then take the outcome of **weak demand** (\$10M) and multiply it by its probability (.40) and add them together.

$$\text{EMV} = .60 (\$70M) + .40 (\$10M) = \$42,000,000 + \$4,000,000 = \$46M$$

Deciding Which Path to Take

Take the larger value of the two, which is **\$46M from Upgrade Plant**. This is the best course or path to take because it produces the highest EMV for the company.

This path also has the **lowest risk** because it helps to **avoid the loss** of \$30M in the worst-case scenario (Build New Plant weak demand).



<sup>1</sup> Project Management Institute, *A Guide to the Project Management Body of Knowledge, (PMBOK® Guide)* – Sixth Edition, Project Management Institute Inc., 2017, Fig. 11-5, Page 435.