

Policy Decision (2/2)

الجزء الثاني من المحاضرة

Part 2 of the Lecture

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Risk & Decision Analysis - PMG 621

Lecture 4



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Part 2

Lecture 4

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Attitude toward Risk

Risk attitude, or risk preference, is a fascinating aspect of decision analysis. Unaided intuition, for most people, leads us to make inconsistent tradeoffs between value and risk. That is, most people, unknowingly, make choices that are inconsistent with their long-term objectives. We do better in project evaluations, decisions, and negotiations by understanding the concept of risk preference. This is the purpose of risk policy.



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The uninitiated typically exhibit excessive conservatism. For example, consider the manager of a large project who foregoes a chance to invest \$1 million to gain a 50 percent chance at saving \$10 million in project PV cost. That is, there are equal chances between a \$1 million loss and a \$9 million PVnet gain. This behavior may seem rational if the manager or project has a modest budget.



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"Risk \$1 million with a 90 percent chance of failure?!" A more proper perspective, however, is to consider decision outcomes relative to the size of the entire organization's capital. For the example, the EMV for this decision is:

$$\begin{aligned}\text{EMV} &= -\$1 \text{ million} + [.5 (\$10 \text{ million}) + .5 (\$0)] \\ &= .5 (-\$1 \text{ million}) + .5 (+\$9 \text{ million}) \\ &= \$4 \text{ million.}\end{aligned}$$



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For our example, a risk-neutral decision maker would be indifferent between having \$4 million cash in hand or having this project opportunity. Risk-neutral means being objective about money; that is, the scale of the outcomes does not matter. This means being an EMV decision maker. The EMV decision criterion is widely used in decision analysis, either as a decision criterion by itself or as a reference to the "objective" value.

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How much risk aversion is appropriate for a corporation? The ideal perspective, though perhaps impractical, is to compare the possible project outcomes to the collective net worth of the stockholders. For the second term, one approach is to assess a typical stockholder's net worth and multiply this times the number of stockholders. Very risky projects would have little effect on individual investors. For large, widely held companies, a nearly risk-neutral decision policy is perhaps best. Even for conservative individuals, most persons should be nearly risk-neutral for modest day decisions.



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Upon realizing the implications of conservative selections, most people begin to make future decisions more objectively. An investment like the earlier example will reduce the project's cost by \$4 million on average. This is clearly a good decision in a portfolio of many similarly sized decisions. When the project's value-or, better, the company's value-is large in comparison to the outcomes of a particular decision, the project manager generally will be better off using a neutral attitude toward risk when evaluating alternatives.



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However, if one does want to have a conservative risk policy as a part of the decision policy, there is a straightforward way to do this. We determine a utility function, unique to the DM or organization, that relates "value" (i.e., utility) to wealth. It defines how the DM feels about money. This function also portrays a DM'S risk policy. The utility function transformation provides a guide in how to make tradeoffs between objective value and risk.



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In calculations, we translate outcome value (usually PV) into utility units. The usual methods apply for calculating expected (value) utility. Then, the expected utility decision rule is to choose the alternative with the highest expected utility (EU). The next chapter details this topic.



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Decision Policy Summary

Consistent decisions in an organization require a clear decision policy. Setting the guideline is straightforward, yet most organizations fail to do this. The result is sub-optimal decision making across the organization. Some parts of the organization are rejecting opportunities that would be approved elsewhere.



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Most companies use DCF analysis for project evaluations. Dollars or other currency units measure value. PV discounting reflects attitude about the time value of money. If desired, a utility function expresses a conservative risk policy. Many people may have never seen or heard of the technique. Instead, they subjectively make tradeoffs between risk and value. And, typically, people do this poorly. Fortunately, adjusting for risk aversion is not important for most decisions. If the outcomes are small in comparison to project value, then risk aversion should have little effect on decision making. For most purposes, EMV adequately measures value.



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Example

Crane Size Decision

The problem-solving approach in this example is typical, and illustrates use of the EMV decision rule. In this example, the decision is what Sue Crane to order for a specific task. We will solve this using two different presentation and calculation methods: a payoff table and a decision tree.



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The project manager is planning Activity 15, which requires use of a crane. Table 3.1 shows the crane-sue alternatives and possible outcomes, valued in activity Completion Days. A Medium Crane and a Large Crane are available by rental. The medium-sized crane is adequate in performing Activity 15. A large crane, however, would accomplish the activity faster.

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Time to Complete	Medium Crane		Large Crane	
	Probability	Days	Probability	Days
Quick	0.3	16	0.3	12
Average	0.5	18	0.5	14
Slow	0.2	23	0.2	18

Table: 3.1 Delay Days Given Activity 15 Are Critical



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The decision pending is: Which Size Crane is the best alternative? If the project goes according to the baseline plan, Activity 15 is not on the metical path ("not critical") and does not delay the overall completion time. (Critical path is discussed in Chapter 9 and Chapter 14.) A conventional project analysis sees no benefit of greater crane capacity on the project completion time. In fact, the Large Crane is inferior because of its higher cost.



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However, a stochastic (probabilistic) project model shows the potential for Activity 15 (A15) to be on the experienced critical path. Suppose that the probability that A15 will be critical is .30 (30 percent, the criticality index) with the Medium Crane. That is, there is a .70 chance that A15 will not be critical. Table 3.1 represents best judgments about completion days, regardless of whether A15 is critical.



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Answer by Method 1: Payoff

Table 3.2: Payoff Table for Crane Size Selection

Scenario		Medium Crane		Large Crane	
Time to Complete	Probability	Total Cost	Probability × Cost	Total Cost	Probability × Cost
Not Critical and Quick	.7 × .3	\$34.0	\$7.14	\$39.0	\$8.19
Not Critical and Average	.7 × .5	\$37.0	\$12.95	\$43.0	\$15.05
Not Critical and Slow	.7 × .2	\$44.5	\$6.23	\$51.0	\$7.14
Critical and Quick	.3 × .3	\$306.0	\$27.54	\$243.0	\$21.87
Critical and Average	.3 × .5	\$343.0	\$78.99	\$281.0	\$42.15
Critical and Slow	.3 × .2	\$435.5	\$26.13	\$357.0	\$21.42
Expected Value Cost			\$131.44		115.82

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- Payoff tables are sometimes an excellent way to present a simple decision situation. Most people use computer spreadsheets for the layout and calculations.



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Decision Trees

Decision tree analysis is a standard calculation method in decision analysis. Decision trees can accommodate more complex problems than payoff tables. Trees are often non-symmetric and have subsequent decision points, which are difficult features to represent in a table. The tree diagram is the decision model and serves as a template for calculating expected values. Decision trees are flexible in expressing the logic of a complex decision. Chapter 5 and Chapter 6 feature decision tree analysis. Squares represent decision points, and circles represent chance events.

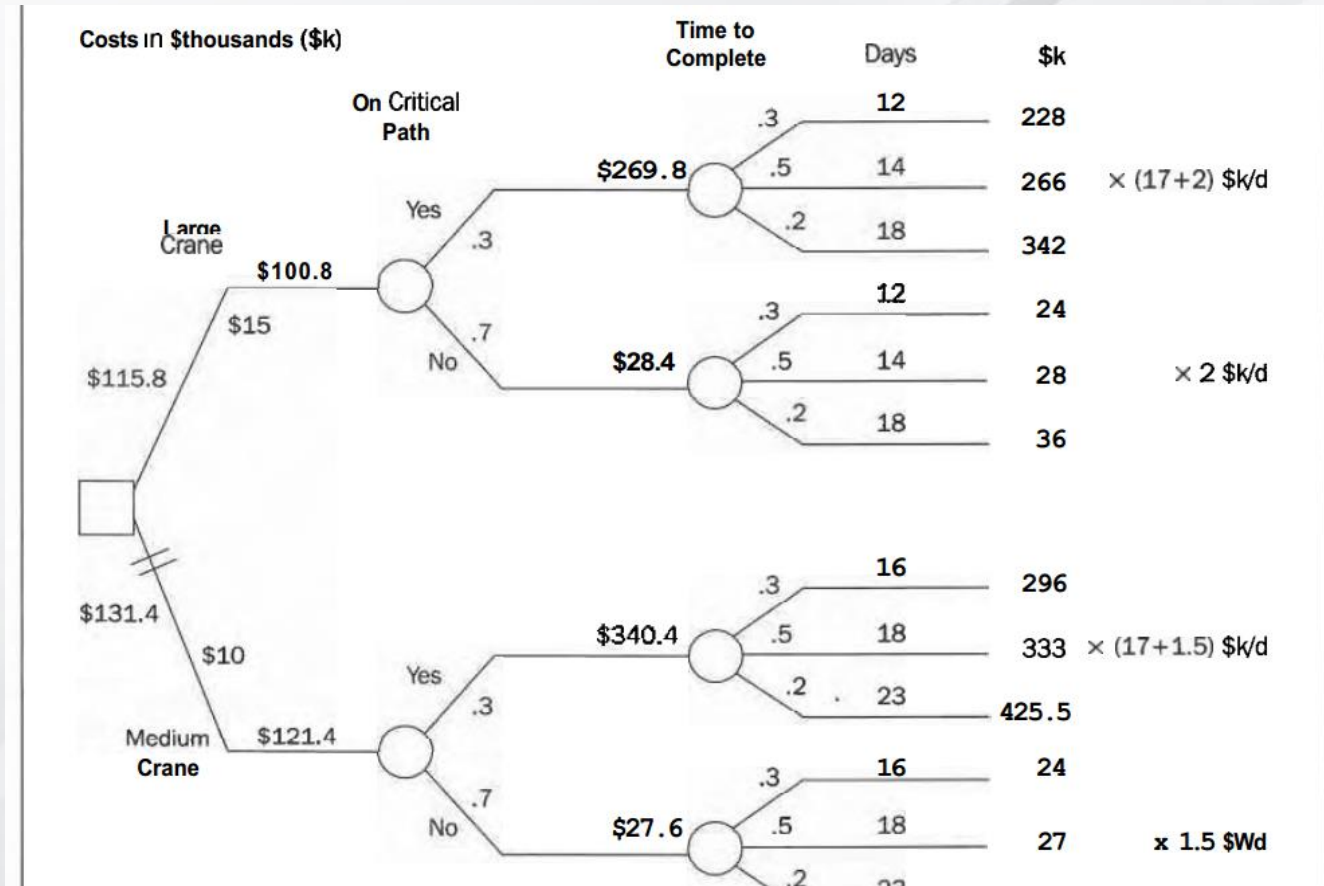


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Figure 3.2 shows a decision tree analysis for the Crane Size problem. We can solve small problems easily without special software. Decision trees can quickly become enormous (hundreds or thousands of branches), and decision tree software is immensely helpful. An example decision tree program is DATA (Decision Analysis by TreeAge), and Figure 3.3 is a screen showing the solved tree.

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Answer by Method : Decision tree



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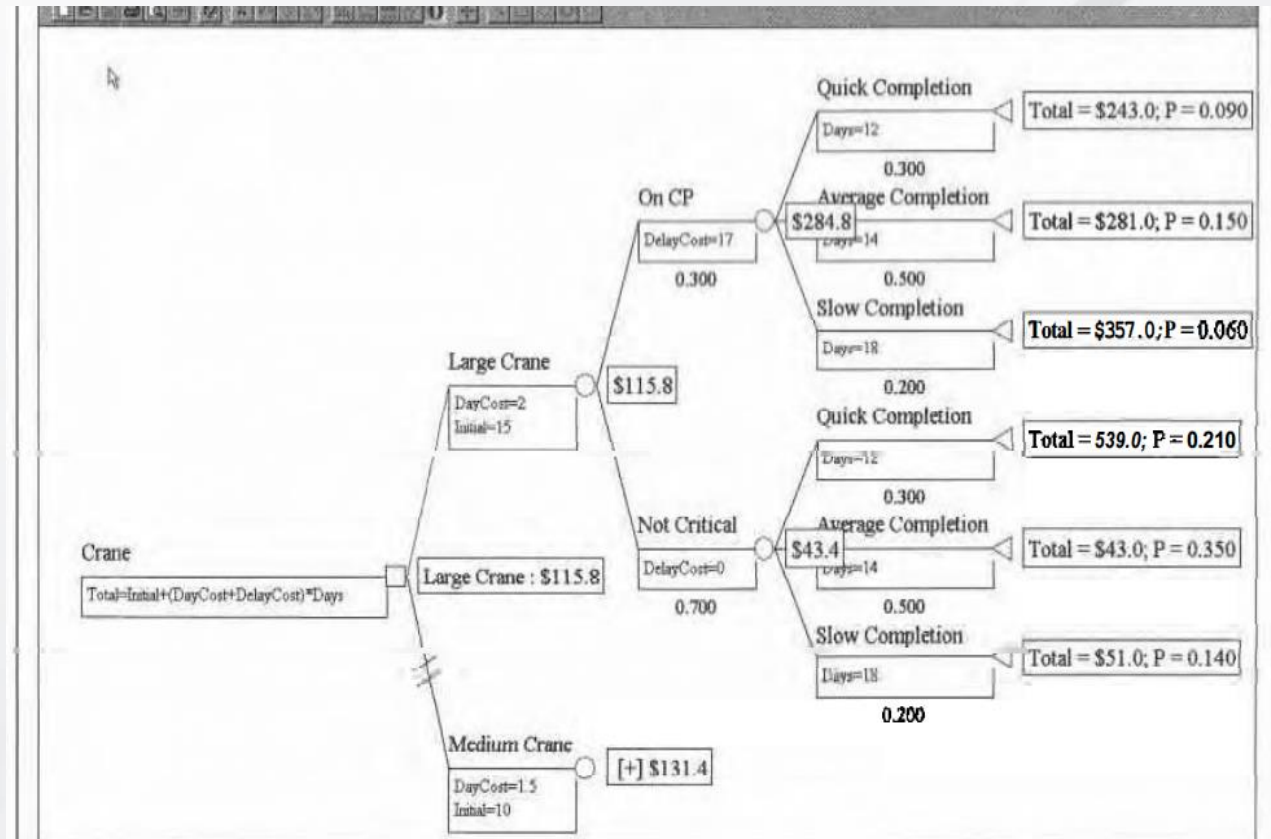
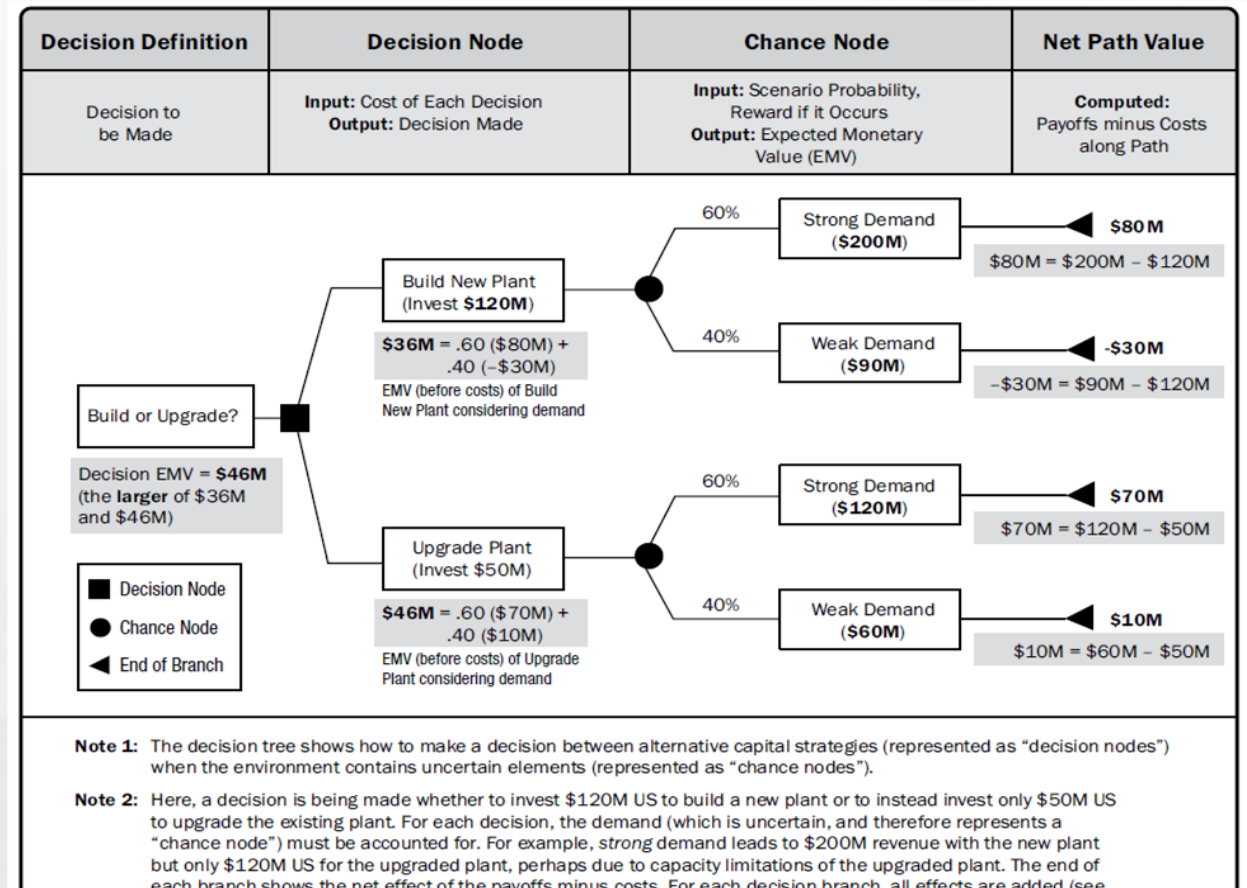


Figure 3.3 Decision Tree Solution with DATA

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Example 2: Decision Tree





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Methods Summary

We have now seen two decision model formats: a payoff table and a decision tree. The payoff table works adequately in simple decision models involving a single decision point, several alternatives, and several discrete outcomes. Usually, the chance events in these tables apply symmetrically to every alternative. Decision trees are better able to represent sequences of chance events and subsequent decision points. A problem's structure is often different for each alternative, and decision trees handle this easily.

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Recourse:

RISK and DECISION ANALYSIS in Projects

Second Edition

By: John Schuyler

From Chapter 3 in Book
(Lecture 3 & 4)



Thank You