Risk and Reward

Litigation Risk Analysis: The Economics of Patents and Litigation, Part IV

By Samson Vermont

Last month, we examined the basic costs of patent litigation and introduced ourselves to the bare bones of decision tree analysis. A full exploration of the field of decision analysis is far beyond the scope of this series. To generate a feel for it, however, this month's installment provides a sampler of common decision analysis issues, tools and techniques. (Readers may contact Vermont directly for a copy of Parts I-III of this series.)

Scope of Analysis

A good decision analysis is straightforward and flexible, acknowledges both subjective and objective factors, blends analytical with intuitive thinking and requires only as much information and analysis as is necessary to resolve the particular dilemma.[1] A good decision analysis also focuses on fundamental ends and takes care not to confound them with their means. Otherwise, double counting inflates the importance of those ends.

Decision analysts universally recommend keeping it as simple as possible. For example, Marc Victor's guiding principle is that the tree should mirror the judge's or jury's level of analysis, and should avoid capturing the minutiae that lawyers often spend much time exploring but which judges and juries won't use to arrive at their ultimate rulings and verdicts.[2]

Studies show that decision trees are quite robust and, except for one or two crucial variables, small alterations in estimated probabilities or payoffs won't reverse the overall superiority of one option over another. Fine tuning is more justified, however, when the options are not a simple "yes" or "no" but involve a continuous variable[3] with no clear boundaries, as in "how much money should we offer?"

An acceptable decision tree can usually be drawn up in one to ten days if the experts and decision makers are available, but in complex and very high stakes cases it may take several weeks.[4]

Countering Biases

Analysts must mitigate motivational biases, and cognitive biases[5] such as overemphasis on recent data; availability (which refers to considering events that are easy to visualize as more probable);[6] representativeness (which refers to placing more confidence in a single piece of information that is considered representative rather than in a larger body of generalized information); ignoring regression to the mean (which refers to expecting extremes to follow extremes)[7]; overestimating the probability of conjunctive events (e.g., not appreciating that if seven independent events are each 90 percent likely to occur, the chances of all occurring is only .48, i.e., .9*.9*.9*.9*.9*.9*.9); misjudging the probability of disjunctive events (e.g., not appreciating that if 10 machines have a 1/100 chance of failing, the odds that one will fail is almost 1/10); supra-additivity (when asked for large numbers of *mutually exclusive* and exhaustive probability assessments, the sum of subjects' assessments often exceeds 100 percent)[8]; and others.

Anchoring is one of the most prevalent biases.[9] It refers to the fact that people tend to cluster their answers around an initial number. For example, imagine you ask an expert "given these conditions, what is the award amount that is at the 50th percentile, i.e., at which half of awards fall below and half fall above?" You then say "what is the amount at the 60th percentile?" And then "what is the amount at the 70th percentile?" Many studies show that the estimate of the 60th, 70th and every percentile thereafter will tend to be closer to the 50th percentile than if, for example, you first asked "what is the amount at the upper 90th percentile?" This bias is so robust that even when a computer generates a random number, and the subject is told it's random, the subject will still tend to cluster answers around it. To counter anchoring, analysts initially avoid the medians and jump around unpredictably in their questioning. For example, they start at the 95th percentile, then ask about the bottom 10th, then about the 65th, etc.

Another prevalent bias is overconfidence, especially with regard to underestimating the range of probabilities.[10] In other words, people usually estimate ranges that are too narrow. To counter this, analysts postulate extremely favorable and unfavorable results, and then ask the expert to work backward to explain the chain of events that could lead to those results. Indeed, if the expert hasn't thought through the bases for his estimates, they're of little value. Therefore, before eliciting probabilities, analysts commonly prime experts by asking them to create comprehensive lists of reasons that support or underlie estimates they will soon proffer.[11]

Studies show that even when we're aware of biases, they still affect us. So if you plan to incorporate your own estimated probabilities, do so before you hear others' estimates, but preferably after you hear their list of reasons.[12]

Clarity

Obtaining good probabilities requires unambiguous questions and numerical answers. Do not ask: "do you think the event is very likely, likely, unlikely or very unlikely?" People ascribe decidedly different meanings to terms such as likely, probably, doubtful, expected and possible. In one study, participants were asked to rank ten such terms in decreasing order of uncertainty. 'Likely' ranged from second place to seventh place, while 'unlikely' ranged from third to tenth.[13]

Also, avoid asking for percentages when you're inquiring about increases or decreases. For example, imagine some legal outcome has happened ten percent of the time historically, but a new court decision makes that outcome more probable. If you ask lawyers "by what percent did the decision increase the chances of the outcome?" some might say "20 percent" and mean that the initial 10 percent will increase by 20 percent to become 12 percent (1.2 * .10). Others will say "20 percent" and mean that the 10 percent will triple to become 30 percent (10 + 10 +10). Others will say "20 percent" and mean that the 20 percent *replaces* the 10 percent, thereby doubling the initial 10 percent.

When possible, frame probability questions in terms of frequencies: "if it occurred 10 times out of a hundred before, how many times out of a hundred will it occur now?"

Weighting Averages

In major litigation, it's best to obtain probability estimates from up to (but usually no more than) five individuals.[14]

Since some individuals are more experienced and have better judgment than others, analysts must sometimes[15] determine who has the best judgment and to what extent to weight it, using factors such as the individual's confidence in his own particular judgment; colleagues' confidence in the individual's judgment; the analyst's confidence in the individual's judgment; and objective indicators such as years of experience and other credentials. (For our decision trees, we'll use actual average and median figures, rather than quantifying the judgment of an expert.)

Sensitivity Analysis

It's usually the case that some variables are much more important or volatile than others. Sensitivity analysis entails holding every variable constant except one, and then changing the value of that one to measure its effects on overall expected value.

Sensitivity analysis prunes issues by telling us which uncertainties are most crucial and where we should focus on eliciting more realistic probabilities. It also tells us where to allocate legal resources to change outcomes. In a patent suit, for example, sensitivity analysis may indicate that the possibility of infringement under the doctrine of equivalents is ten times more crucial than the possibility of willfulness damages, which counsels in favor of shifting attention from the latter to the former. Or, we may want to know how much of an increase in the probability of infringement liability is justified per unit decrease in the probability of lost profit damages (as opposed to reasonable royalty damages).[16]

In a real case, sensitivity analysis is a must. “Its importance cannot be overstated.”[17]

Value of Control

To determine how much to spend on various pre-trial activities, analysts ask: “what is the most we would be willing to pay a wizard to guarantee a certain holding or outcome?”[18] For example, how much would we pay to guarantee that our patent will be deemed valid? To determine this value, analysts who have performed an initial tree analysis change the probability of the event in question to 100 percent and then “roll back” the tree again. This gives the expected value of the tree with perfect control which, when subtracted from the original expected value of the tree, leaves the value of perfect control.

To determine the value of imperfect control, they ask, for example, “how much would we pay to decrease the possibility of liability by 15 percent?” Analysts then change the original probability of the event (X percent) to the new value (X - 15 percent) and roll back the tree.

Value of Information[19]

Determining the value of information is particularly useful in patent suits because discovery accounts for the brunt of their costs. Paying lawyers to pursue discovery is nothing more than purchasing information and evidence. As with any other purchase, we should estimate the value of what we’re purchasing.

Determining this value begins with determining the value of “perfect” information. That is, after we’ve constructed a decision tree, we pick a chance node we’re interested in and we ask “If a clairvoyant could tell us with perfect certainty whether an event will occur, how much would that information be worth?” That worth is determined by a technique similar (but not identical) to the technique for determining the value of perfect control.

The value of perfect information sets a ceiling. If you're spending more than the value of a particular batch of perfect information to discover that information, you're spending too much. Analysts estimate the value of imperfect information by discounting the value of perfect information by the estimated quality of the imperfect information.

Software

In the installments that follow, we'll run through tree analyses more or less manually, doing most of our own arithmetic. Decision analysis computer programs can automate some of these calculations. Such programs include @RISK, Precision Tree, Expert Choice, DPL, HIVIEW and others.

By far, the most popular package among lawyers is DATA by TreeAge Software Inc., screen shots from which constitute the figures shown in last month's installment and in future installments.

Other Tools

Analysts use a variety of devices to visually depict or elicit probabilities. The most common is the probability wheel, which is simply a pie chart with two pie slices, one of which can be adjusted to decrease or increase its size relative to the other slice. One slice represents the probability that the event in question will occur; the other slice represents the probability that it won't. The analyst changes the size of the first slice until the expert intuitively feels that it represents the correct probability.

Despite it's goofy simplicity, research shows that it's the best way to obtain a realistic probability. Computer programs such as DATA often include electronic probability wheels.

***

In the next installment, we will pose a hypothetical suit and start analyzing it with decision trees.

Samson Vermont is an associate in the Washington DC office; the founder, a columnist and an editor (formerly chief editor) of the monthly periodical Patent Strategy & Management; and an advisor and columnist for the new monthly periodical The Patent Journal. A compiled version of the Risk and Reward columns will be published in the form of a book chapter entitled 'Business Risk

Analysis: The Economics of Patent Litigation,' which will appear in the anthology *From Ideas to Assets: Investing Wisely in Intellectual Property*, ed. Bruce Berman (John Wiley & Sons Dec. 2001).

---

[1] John S. Hammond, Ralph L. Keeney and Howard Raiffa, *Smart Choices: A Practical Guide to Making Better Decisions* p.4 (Harvard Business School Press 1999).
[2] Marc B. Victor, Evaluating Legal Risks and Costs with Decision Tree Analysis, ch.12 in *Successful Partnering Between Inside and Outside Counsel* (West Group/American Corporate Counsel Association 2000) (Victor's best article on the subject).
[3] Continuous is the opposite of discrete. For example, a light switch has a discrete variable—it's either on or it's off. There is no in-between. On other hand, money is a continuous variable because it increases or decreases incrementally forever.
[4] Marc B. Victor, Personal Telephone Communication (April 2001). Compare Paul Goodwin and George Wright, *Decision Analysis for Management Judgment* 2nd ed. 156-62 (John Wiley & Sons Inc., 1998).
[5] See generally Symposium: Legal Implications of Human Error, 59 *S. Cal. L. Rev.* 225 (no.2, Jan. 1986); Carl S. Spetzler and C.A. Stael Von Holstein, Probability Encoding in Decision Analysis, 22 *Management Science* No. 3 (Nov. 1975); Daniel Kahneman, Paul Slovic, and Amos Tversky, Judgment under uncertainty: Heuristics and biases (Cambridge University Press 1982); Amos Tversky and Daniel Kahneman, Judgment Under Uncertainty: Heuristics and Biases, 185 *Science* 1124-31 (Sept. 26, 1974); Goodwin and Wright, supra at 248-273.
[6] Samson Vermont, Memes and the Evolution of Intellectual Dishonesty in Law, 22 *Legal Studies Forum* 655 (1998); – Why "Law and Economics" is Not the Frankenstein Monster, 15 *Economics & Philosophy* (1999).
[7] See Goodwin and Wright, supra at 254-255.
[8] See Id. at 284-285.
[9] David C. Skinner, Introduction to Decision Analysis, 2nd ed., p.204 (Probabilistic Publishing, April 1999).
[10] In one study, subjects who were asked to estimate ranges wide enough to have a 90 percent chance of including a true value—such as the actual distance from England to Chile—estimated ranges that included the true value only 57 percent of the time. Goodwin and Wright, supra at 259-260.
[11] Marc B. Victor, Personal Telephone Communication (April 2001).
[12] Hammond, Keeney and Raiffa, supra at 52.
[13]See P.G. Moore and H. Thomas, *The Anatomy of Decisions*, 2nd ed. (Penguin 1988); Goodwin and Wright, supra at 73-74.
[14] See generally Goodwin and Wright, supra at 298.
[15] Research shows that simple averages usually produce overall outcomes that are as good as weighted averages. See Goodwin and Wright, supra at 298-300.
[16] See generally Bruce L. Beron, *Litigation Strategies & Risk Management Seminar Materials* (LRMI 2000).
[17] Goodwin and Wright, supra at 275.
[18] See generally Beron, Seminar, supra.
[19] See generally Goodwin and Wright, supra at 227-243.