EVALUATING LEGAL RISKS AND COSTS WITH DECISION TREE ANALYSIS

by
Marc B. Victor, President, Litigation Risk Analysis, Inc.;
Craig B. Glidden, VP and General Counsel, Chevron Phillips Chemical Company LP;
Clyde W. Lea, Deputy General Counsel, Litigation and Environment, ConocoPhillips;
and J. Bryan Whitworth, former SVP, General Counsel, Phillips Petroleum Company

§ 12:1   Scope note

This Chapter discusses and contrasts "intuitive" and "quantitative" models for making decisions about which risks to take and which costs to incur in the corporate legal environment. With the goal of facilitating decision making, achieving better results, and reducing unnecessary costs, Phillips Petroleum Company ("Phillips") has embraced a quantitative model for evaluating its litigation portfolio and making other legal decisions. Phillips' experience in successfully implementing a quantitative model is a useful example of the opportunities and challenges presented by eschewing a solely intuitive approach to legal decision making.

The primary focus of this Chapter will be the application of quantitative analysis *to litigation,* the most common area of risk management encountered by corporate counsel.[1] Although litigation is the primary focus, the principles and practices discussed are equally applicable to other aspects of the legal function. The methodical application of risk and cost management techniques can enhance the performance of any legal function, such as conducting due diligence examinations, planning strategy for regulatory proceedings, and structuring business transactions.

The particular quantitative model described in this Chapter is a form of decision tree analysis called Litigation Risk Analysis™ ("LRA"). This procedure, developed by attorney Marc B. Victor, has been utilized by numerous in-house legal departments, including Phillips, and by many outside law firms. Its primary tools for analyzing risk in the litigation context will be examined: the Dependency Diagram, the Decision Tree, and the Sensitivity Analysis. Use of these tools — ideally by in-house and outside counsel working together, with the assistance of a litigation risk specialist on complex, high-exposure matters — will be shown to promote a better understanding of the key areas of litigation uncertainty and the factors primarily influencing them, and a more realistic assessment of the potential range of litigation results. Once the litigation alternatives, probabilities and potential economic gains or exposures are identified, the costs of achieving these objectives are analyzed. Most importantly, this process fosters the focused use of legal resources to maximize the probabilities of success. In addition, LRA simultaneously provides a basis for determining a reasonable settlement value for any dispute.

The LRA methodology can be applied to all types of litigation, from once-in-a-lifetime, bet-the-company commercial disputes to high-volume, small personal injury claims. When implemented, such an explicit and formalized methodology for analyzing and deciding on litigation risks offers great benefits to all involved — in-house counsel, their corporate clients, and their outside legal advisors.

---

[1] In this Chapter, the term risk will be used to connote both the exposure to loss and the opportunity for gain. While corporate clients are usually called upon to defend lawsuits, it is also true that corporations pursue litigation to obtain business or economic benefits. The principles articulated in this Chapter are equally relevant to litigating as a plaintiff or as a defendant.

§ 12:16   Analysis of risk, cost and value[2]

As has been noted in Section 12:3, *supra*, performing a comprehensive risk analysis usually serves several purposes: in addition to providing a quantitative analysis of the risks inherent in pursuing a given legal strategy, it imposes a valuable rigor on the attorney's identification of the important issues and forces a thorough understanding of their significance. To illustrate, consider the following problem:

> Two years ago, your company, Eagle Oil Incorporated, executed a Marketing Agreement with Sparrow Corporation whereby Eagle would encourage and support installation of Sparrow's aviation system at Eagle's customers (and at businesses not yet served by either), while Sparrow would provide its system to businesses that used Eagle fuel. Sparrow has recently filed a complaint against Eagle, alleging breach of contract, as well as detrimental reliance, and fraudulent and negligent misrepresentation.
>
> Specifically, Sparrow now claims that Eagle breached the provision of the Agreement obligating Eagle to "use its best efforts to implement the installation of Sparrow's product with customers of Eagle and others … ." Sparrow also claims that Eagle induced execution of the Marketing Agreement on the basis of deliberate and false representations regarding Eagle's commitment of personnel and money to the undertaking and regarding its ability to deliver business to Sparrow. Sparrow further alleges that, even independently of any contract rights, it detrimentally relied on the promises made by Eagle and invested substantial amounts of money, time and other resources.
>
> Sparrow is seeking damages of $20 million — $2 million for the capital investments it made in reliance on Eagle's promises, $8 million for the present value of its lost profits, and $10 million in punitive damages.
>
> Eagle denies Sparrow's allegations in their entirety. Furthermore, your business people have told you that the reasons why Sparrow has incurred losses on its product are because it was overpriced and because of technical problems that Sparrow was slow to solve.

---

[2] For an in-depth treatment of decision tree analysis, see Clemen, Robert T., Making Hard Decisions: An Introduction to Decision Analysis (Wadsworth Publishing Co. 1996); Marshall, Kneale T. and Oliver, Robert M., Decision Making and Forecasting (McGraw-Hill 1995); Raiffa, Howard, Decision Analysis: Introductory Lectures on Choices Under Uncertainty (McGraw-Hill 1968); Skinner, David C., Introduction to Decision Analysis: Beginning Coursebook (Probabilistic Publishing 1999).

§ 12:17 — Dependency diagrams

The first step in performing a good risk analysis of litigation is to identify the uncertainties that will affect the amount of money[3] your client will be ordered to pay (if defendant) or will be awarded (if plaintiff), and to explore their interrelationships using a *dependency diagram.* A dependency diagram (such as the partial one in Figure 1), therefore, consists of two parts: (1) a description of the uncertainties counsel feels the judge and/or jury will consider (the questions in the bubbles) and (2) a statement of how each uncertainty impacts the chances of liability or the amount the client will pay or receive (the comments on the arrows).
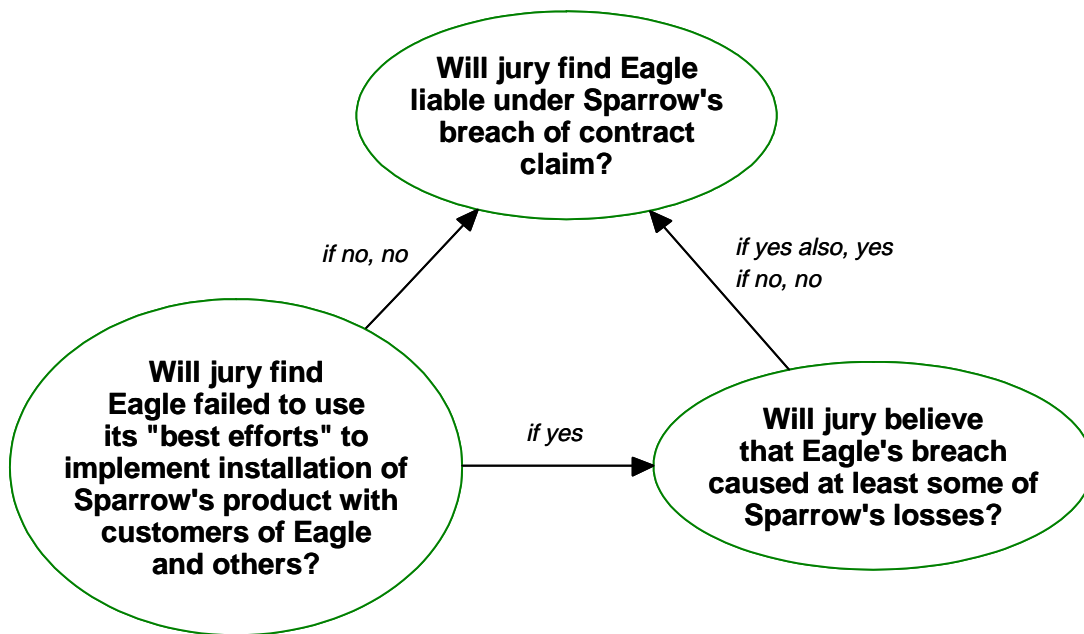

FIGURE 1. PARTIAL DEPENDENCY DIAGRAM
— Analysis of a Single Claim —

At the outset of Section 12:16, *supra,* it was stated that the exercise of performing a risk analysis "imposes a valuable rigor on the attorney's identification of the important issues and forces a thorough understanding of their significance." This occurs as a result of the two basic rules for constructing a good dependency diagram:

Rule I — Concerning the uncertainties in the bubbles: Write each as a long, unambiguous question, framed the way you think the trier would. In other words, avoid using only one- or two-word legalese such as "breach" and "proximate cause."

---

[3] This discussion focuses on litigation in which the sole consequence is the potential exchange of money between the parties. Of course, in some cases the primary or sole consequence of concern is the possibility of injunctive relief, while in others it is the possible precedential effect on existing or likely additional lawsuits. Although these consequences may be difficult to value in dollar terms — and may require the identification and eventual quantification of additional uncertainties such as "How much will my market share change if I must redesign my product?" or "How many more lawsuits will I get if I lose this one? If I settle this one?" — litigation that raises such issues can and should also be subjected to a rigorous risk analysis such as described throughout this Chapter.

Rule II — Concerning the arrows and their associated comments: For each uncertainty, be sure to identify what the consequences are of both a favorable and an unfavorable result. In other words, indicate what other issues are impacted, and in what way.

In cases with multiple claims, it is especially important to try to construct a complete dependency diagram. In Figure 2, for example, which issues should be interconnected and how should each arrow be labeled? If the jury thinks Eagle *did* breach the contract, is it important to analyze the other two claims? And if the jury does *not* think Eagle breached the contract, could the jury nonetheless find detrimental reliance or fraudulent misrepresentation? What if the jury does not think Eagle fraudulently misrepresented something material to induce execution of the contract, could the jury still find Eagle liable for detrimental reliance? And even if the jury *technically could*, do you think it *would* — in other words, if Sparrow's facts and witnesses did not persuade the jury to find fraudulent misrepresentation, do you think the same facts and witnesses would persuade the same jury to find detrimental reliance? If not, are there any *other* facts you could imagine Sparrow pointing to on the latter claim that it would not have used on the former one? As shown in Section 12:18, *infra*, if the legal reasoning that is implied by the arrows and comments is flawed, so will be the decision tree, and thus, so will be the quantitative results.
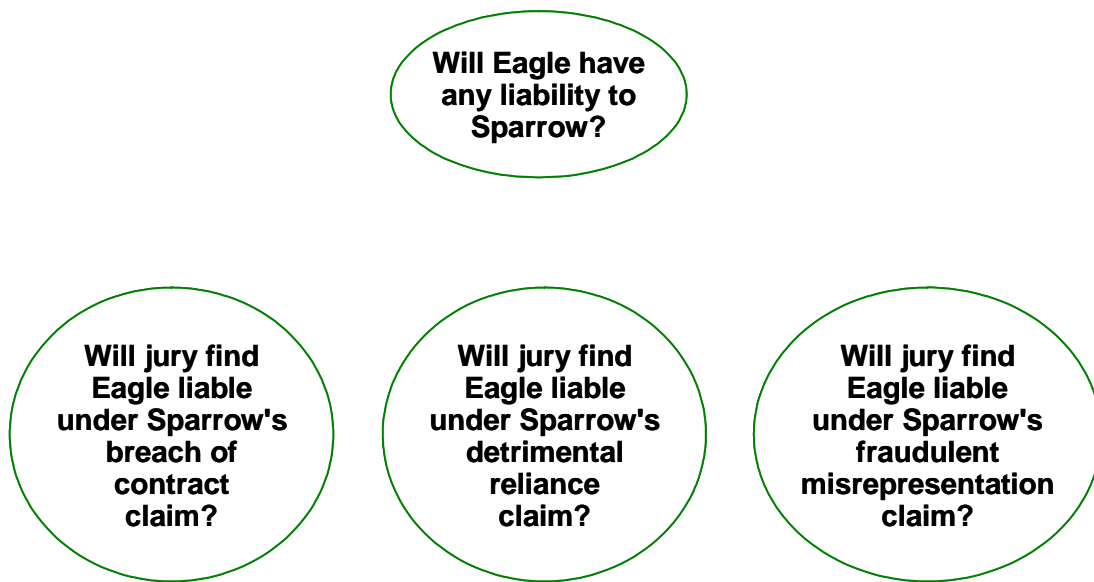
FIGURE 2. INCOMPLETE DEPENDENCY DIAGRAM
— Analysis of Multiple Claims (Missing Arrows and Comments) —

4

A thorough dependency diagram will also show the key damage uncertainties, and specify how different liability claims either allow for or preclude the award of different types of damages as a matter of law. For example, the *Sparrow v. Eagle* dependency diagram might indicate that punitive damages could be awarded under the fraudulent misrepresentation claim but not, in this jurisdiction, under the breach of contract or detrimental reliance claims. Legal uncertainties can and should also be included on the diagram. For example, if it is uncertain whether the trial judge or appellate court will allow for a type of damages (*e.g.*, lost profits) to be awarded under a particular liability claim (*e.g.*, detrimental reliance), the diagram should include a bubble reflecting that uncertainty as well as the jury uncertainty of "how much," as illustrated in Figure 3. (Note that Figure 3 has been constructed as if Sparrow's *only* claim was for liability arising out of detrimental reliance.)
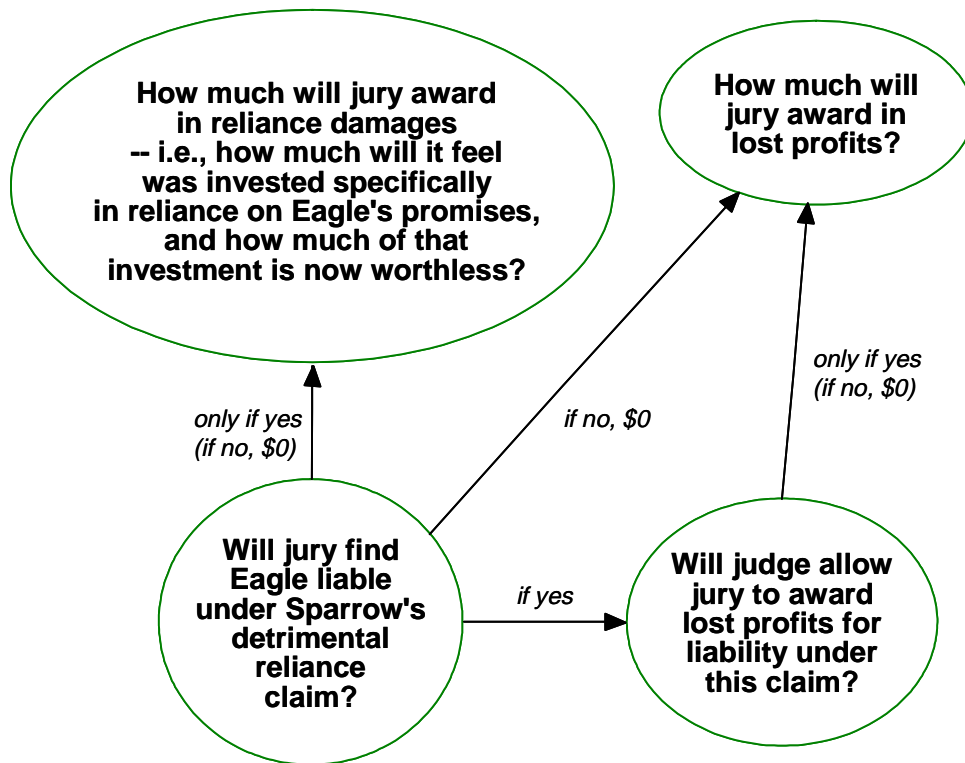
FIGURE 3. PARTIAL DEPENDENCY DIAGRAM
— Damage Analysis of a Single Claim —

Finally, a dependency diagram should capture those evidentiary uncertainties upon which other key issues depend. (Hence the name "dependency" diagram.) For example, if the jury's likelihood of finding liability depends significantly on the judge's ruling with respect to the admissibility of some testimony, or on your ability to locate a particular document or witness, the diagram should so indicate. *See* Figure 4.

Will jury find Eagle liable under Sparrow's fraudulent misrepresentation claim?

if yes, hurts
if no, helps

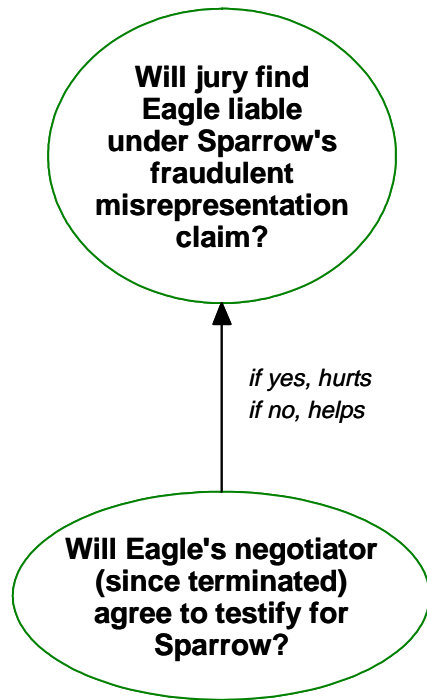Will Eagle's negotiator (since terminated) agree to testify for Sparrow?

FIGURE 4. PARTIAL DEPENDENCY DIAGRAM
— Inclusion of an Influencing Uncertainty —

§ 12:18 — Decision trees

When the attorney responsible for the case has captured all of the key uncertainties and their interrelationships in the correct dependency diagram, this information is then converted into a *decision tree* (or in complex cases, a "main" tree and a number of "sub" trees). The decision tree will show all of the possible litigation scenarios implied by the dependency diagram, along with their respective consequences, and thus is a powerful tool in communicating with the business client how the legal and factual uncertainties in a case could play out. In addition, the decision tree provides the framework for combining probabilities and verdict ranges to arrive at the case value, much as an income statement provides the framework for combining various income and expense items to arrive at net profit. *See* Section 12:21, *infra.*

If the dependency diagram is complete — i.e., if all important liability and damage, legal and factual, uncertainties have been included, *and* if the legal reasoning implied by the existence (or non-existence) of specific arrows along with their associated comments is sound — converting it into the correct decision tree does not require any further legal expertise. That has already been fully captured in the dependency diagram. Instead, one merely needs to follow a few rules. These are best understood while comparing the dependency diagram of Figure 3, *supra,* with the decision tree of Figure 5, *infra.*[4]

Rule I — Any uncertainty at the *base* of an arrow must go earlier in the tree than (*i.e.,* to the left of) the uncertainty at the *tip* of that arrow.

Rule II — There are as many "branches" for an uncertainty as there are possible ways in which the uncertainty could be resolved. An exception is that range-type issues (*e.g.,* "How much will the jury award for reliance damages?") are usually approximated with three branches representing high, middle, and low values along the potential range.[5]

Rule III — An uncertainty (which is indicated in the tree by a circle, or "chance node") must be *appended to all relevant branches* of the prior uncertainty, such that each uncertainty occupies its own "column" in the tree.

---

[4] Although the decision tree in Figure 5 reflects everything contained in the dependency diagram of Figure 3, because this dependency diagram was only a "partial" one of a far more complex dispute, this decision tree in turn is far simpler than the full tree that would correctly reflect the *entire* problem. That tree would need to capture all of the liability theories (*see* Figure 2, *supra*), including the elements the jury would focus on (*e.g., see* Figure 1, *supra*), all key evidentiary uncertainties (*e.g., see* Figure 4, *supra*), and all related damage issues.

[5] In truth, the decision tree at this stage of the risk analysis would typically not yet have dollar amounts on the branches (and thus would not have computed "Totals" at the end of each scenario). Instead, one would see only the words "high," "middle," and "low" on the branches. It is not until the ranges have been carefully assessed (*see infra* § 12:20) that dollar amounts can be placed on the branches and that totals can be calculated. Dollar amounts have been placed prematurely in this tree to make it easier to understand.
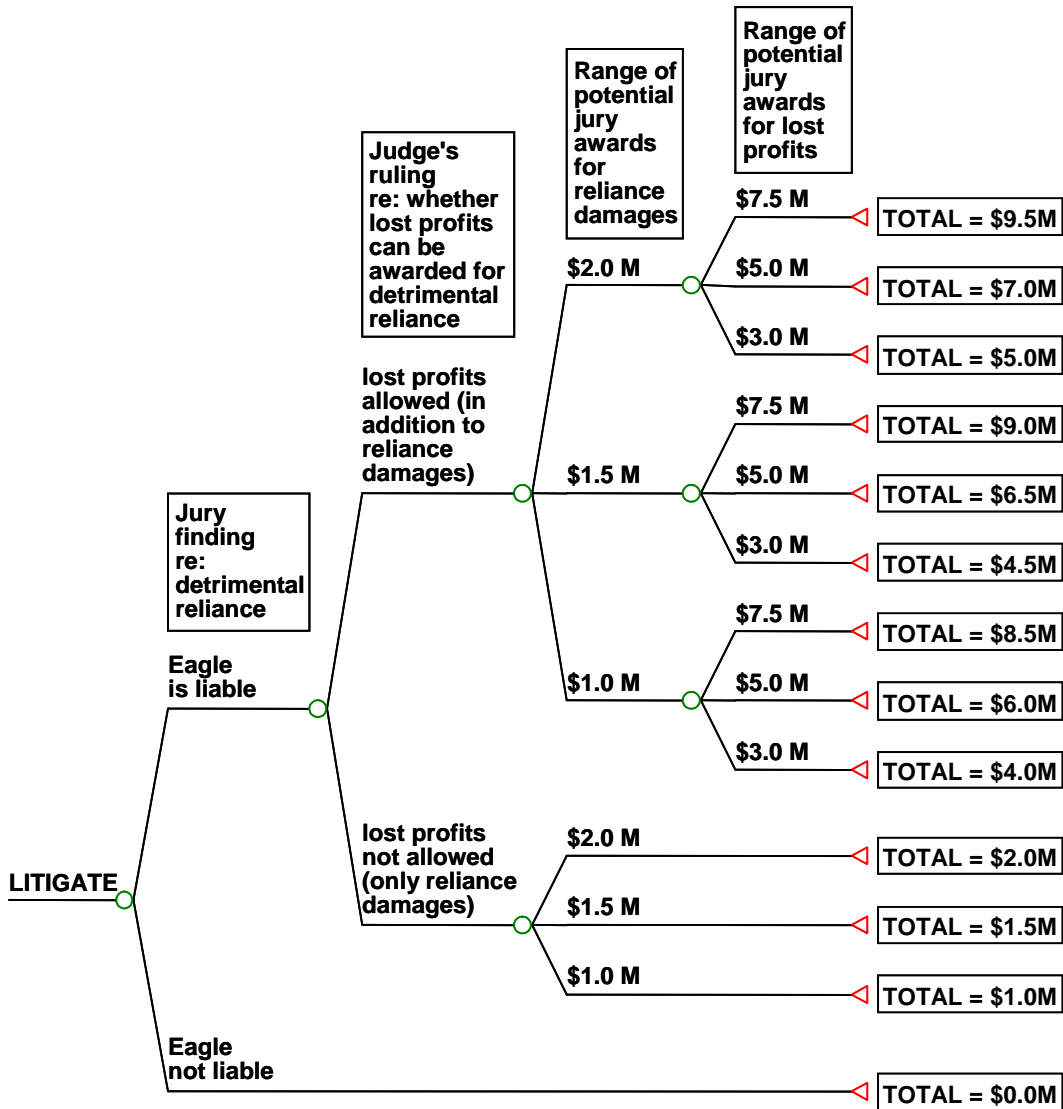
FIGURE 5. DECISION TREE
— Corresponding to Issues Shown in Dependency Diagram at Figure 3 —

§ 12:19 — Lists of reasons

In order to assess realistic probabilities and verdict ranges, counsel must first think about all the things that the trier will be thinking about when it decides the case. Thus, the next step in performing a correct risk analysis consists of collecting the information — both pro and con — that is relevant to each of the uncertainties in the decision tree.

Some of this information will be readily available — *e.g.*, contract terms, product specs, key client correspondence, interviews with employees, case law, knowledge about the judge, experience with juries in the venue, the skill of opposing counsel, etc. Other information will develop more slowly — *e.g.*, from interrogatories and depositions, expert witness studies, community surveys, *etc.*

Both because an early assessment of risk may be desired, and because the exercise of thinking about how an issue might be won or lost can greatly increase the efficiency and success of one's pretrial activities, counsel is encouraged to develop *lists of reasons* at an early stage of the problem. These lists of reasons should summarize information on hand *as well as* facts that either side might uncover during discovery, evidentiary rulings the judge might make, or information you might be able to develop that would improve your chance of winning. By including the latter types of factors, you will reduce the chance of unpleasant surprises and improve the chance of having winning arguments and evidence to present at trial. As the case progresses, the lists can be easily updated.

One list (with a "pro" side and a "con" side) should be developed for *each* uncertainty captured in your decision tree. A sample list of reasons has been started in Figure 6. Information not yet developed, or uncertainties not yet resolved, are preceded by "IF."

Reasons Why Jury Finds Eagle FAILED to Use Its Best Efforts	Reasons Why Jury Finds Eagle DID Use Its Best Efforts
• Eagle is such a large company (with annual sales in the billions), yet it only assigned 1 person full-time to market the Sparrow product • Eagle's significant witness may be defensive on cross • Eagle was slow to include Sparrow's product in its promotional material • IF any evidence surfaces that Eagle thought installation of Sparrow's product would actually reduce Eagle's sales • Jury upset that Eagle did not tell Sparrow that one of Eagle's largest customers was about to install a competing product, so Sparrow could make a sales pitch before customer signed contract • IF judge allows Sparrow to testify about all the "requirements for success" it outlined to Eagle during the negotiations over the agreement, even though these were not incorporated into the final written agreement • IF the judge instructs that "best efforts" language imposes a requirement *substantially greater* than just "good faith efforts" would	• Eagle had every incentive to try to make Sparrow's product a big success, since Sparrow would help promote Eagle fuel at new locations • Although Eagle is a large company, the division that entered the agreement with Sparrow is about the same size as Sparrow • Although Eagle assigned only 1 person full-time to market the Sparrow product, lots of other employees spent part-time on the project {note to file: need graph showing total # of hours and dollars spent, company-wide, and some way of making these look enormous} • Eagle's promise to use best efforts to implement installation of Sparrow's product did not obligate it to sacrifice its own interests; Eagle was afraid that if it told customer who was about to install competing product to "hold off," customer might drop Eagle as fuel supplier • IF Eagle can get customers to testify on its behalf, both about Eagle's efforts and about the technical and financial reasons they chose not to install the Sparrow product • More recent cases in this state equate "best efforts" with "in good faith and in accordance with fair dealing," and not much more than that

FIGURE 6. PARTIAL LIST OF REASONS
— On Issue of "Best Efforts" —

§ 12:20 — Probability and verdict ranges assessments

Once all of the lists have been developed (as thoroughly as is possible considering the current stage of the litigation), it is time to assess the probability of success on each issue. There are a few important points to bear in mind.

Rule I — Although it is okay to begin your assessment process by thinking that you are "quite likely" to prevail on one issue, or that you have "some chance, but it won't be easy" to win another issue, you will quickly have to convert your opinions into *numerical probabilities* (*i.e.*, percentages). There are two principal reasons for this: (1) the qualitative phrases are much too ambiguous, and (2) there is no good way to combine a "quite likely" on one issue, a "some chance" on another, and so on for all of the uncertainties in a lawsuit.

Rule II — The emphasis should be on providing *realistic* assessments: if 100 juries or judges were simultaneously deliberating the same question, how many would actually rule favorably versus unfavorably? It is counter-productive to be intentionally "conservative" or intentionally "aggressive" with one's assessments.

Rule III — Issues do not exist in a vacuum. Consider what path the trier has followed to get to the issue you are currently assessing, and make your assessment *conditional* on what the trier has already found.

For all uncertainties where there are only two (or a small number of) clear alternative answers (*e.g.*, witness testifies / witness does not testify, defendant liable / defendant not liable, lost profits allowed / lost profits not allowed), it is a straightforward process to review your list of reasons on an issue and make your best guess of the relative likelihood of getting the favorable rather than the unfavorable result. It is advised however, that when possible you also make use of a *probability wheel* such as shown in Figure 7. Years of the authors' experience have shown that people provide more realistic assessments when they can visualize probability and compare their chance of winning (or losing) an issue to the chance of a spinner landing in the darker region of the wheel.[6]
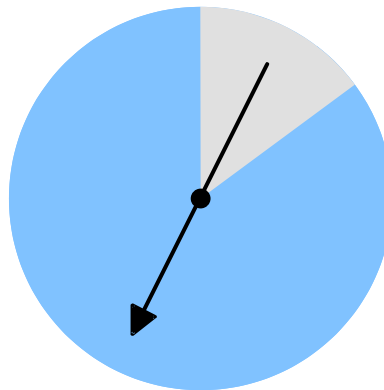

FIGURE 7. PROBABILITY WHEEL

---

[6] The percentage of the dark and light regions is, of course, variable. Once counsel is satisfied that the regions have been appropriately set, the size of each region (in numerical percentages) can be read off the back (if using a paper wheel) or provided by a click of the mouse (if using a software wheel).

For uncertainties where there are an almost unlimited number of possible answers (*e.g.*, the amount of Sparrow's lost profits attributable to Eagle's breach, assuming the jury will be awarding at least some lost profits; or in cases involving comparative fault, the percent share the jury will apportion to a personal injury plaintiff or to a codefendant), some kind of approximation will need to be made. Most frequently, attorneys already think in terms of a "likely verdict range" between some "low" and some "high," plus a "most likely" amount within that range. In these situations, it is natural to think of using a similar three-point approximation when doing a decision tree analysis:[7]

> To avoid confusion, it is suggested that the "low" branch be consistently defined as your best guess of the 10th percentile of the entire potential range, the "high" branch as your best guess of the 90th percentile, and the "middle" branch as your best guess of the 50th percentile. The three corresponding dollar amounts can then be dropped onto their respective branches in the tree.[8] Finally, it is reasonable to think of each of these three amounts as being the *average of a band* of potential awards running from somewhat below to somewhat above. Therefore, add a "±" sign at the end of each of the three amounts and assign a 25% probability to the low amount, a 50% to the middle amount, and a 25% to the high amount.[9]

Traditionally, probabilities are shown in decimal form (*e.g.*, .25 for 25%), and are placed directly under their respective branches on the tree, as in Figure 8.

---

[7] A different approximation than the one that follows would need to be used if counsel's view of the range were different — for example, if counsel thought that the extreme ends of the range were actually more likely than amounts towards the middle.

[8] If a damage award uncertainty is influenced by some other uncertainty (*e.g.*, the amount of punitive damages may depend on the admissibility or inadmissibility of a sensitive internal memo), you will have to assess *two* high-middle-low ranges for the same issue — a higher one to follow the branch where the influencing uncertainty is resolved in plaintiff's favor (*e.g.*, the document is admitted), and a lower one to follow the branch where the influencing uncertainty is resolved in defendant's favor (*e.g.*, the document is excluded).

[9] This suggested approach stems from the fact that the mean of the bottom quartile of a normal distribution is very close to the 10th percentile, the mean of the middle 50% is at the 50th percentile, and the mean of the top quartile is very close to the 90th percentile. Even if you do not think that the range of potential awards in your case exactly describes a normal distribution, the suggested approach will usually be a reasonable approximation so long as you think that as awards move further and further away from your median, they become less and less likely to occur.

Range of potential jury awards for reliance damages

Range of potential jury awards for lost profits

Judge's ruling re: whether lost profits can be awarded for detrimental reliance

Jury finding re: detrimental reliance

LITIGATE

Eagle is liable
0.80

Eagle not liable
0.20

lost profits allowed (in addition to reliance damages)
0.20

lost profits not allowed (only reliance damages)
0.80

$2.0 M ± 0.25

$1.5 M ± 0.50

$1.0 M ± 0.25

$2.0 M ± 0.25

$1.5 M ± 0.50

$1.0 M ± 0.25

$7.5 M ± 0.25 TOTAL = $9.5M
$5.0 M ± 0.50 TOTAL = $7.0M
$3.0 M ± 0.25 TOTAL = $5.0M

$7.5 M ± 0.25 TOTAL = $9.0M
$5.0 M ± 0.50 TOTAL = $6.5M
$3.0 M ± 0.25 TOTAL = $4.5M

$7.5 M ± 0.25 TOTAL = $8.5M
$5.0 M ± 0.50 TOTAL = $6.0M
$3.0 M ± 0.25 TOTAL = $4.0M

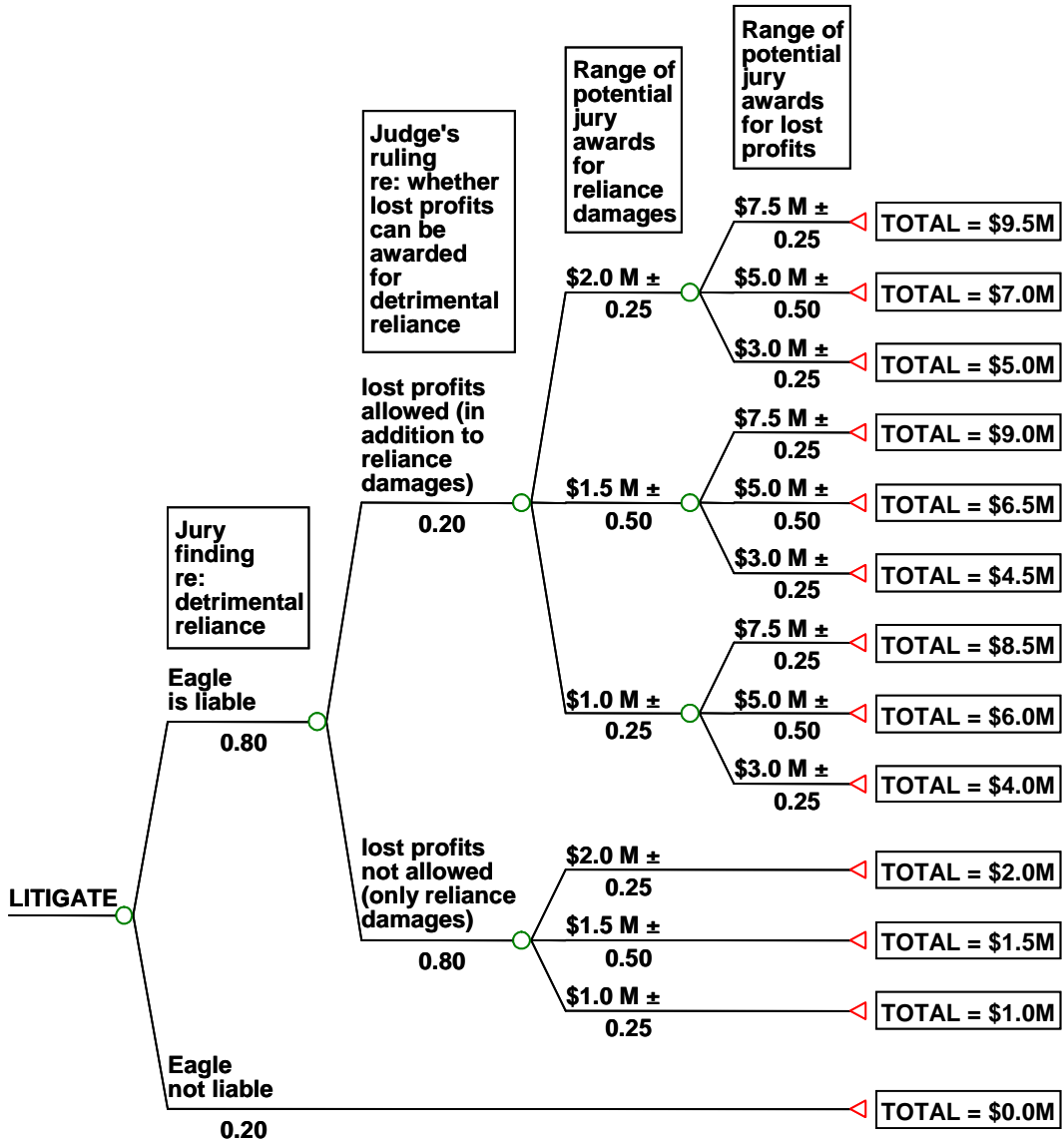TOTAL = $2.0M
TOTAL = $1.5M
TOTAL = $1.0M

TOTAL = $0.0M

FIGURE 8. DECISION TREE
— With Probabilities and Verdict Ranges Assessed —

§ 12:21 — Compound probabilities and the expected value

The most common measure of the value of an uncertain venture is its *expected value*. This is an average value calculated by weighting each of the possible outcomes by its probability of occurring. To use a simple example, the expected value of a fair coin flip for $100 if heads or $0 if tails is $50. But if the coin is not fair and lands heads 75% of the time, the expected value is $75 for the bettor who calls heads.

In order to calculate the expected value of the detrimental reliance case represented by Figure 8, *supra*, it is first necessary to calculate the probability of following each scenario of the tree to its conclusion. Only then will we know how much weight to give to each of the possible "TOTAL" awards. The probability of a combination of events is known as a *compound probability* and is determined by multiplying the percentages of all the events. For example, the compound probability that (1) Eagle is liable, and (2) lost profits are not allowed, and (3) the jury awards approximately $1.0 million for reliance damages (i.e., the next-to-the-bottom scenario of Figure 8) is $0.80 \times 0.80 \times 0.25 = 0.16$. In other words, there is a 16% chance of this scenario occurring based on the three separate opinions of counsel. Figure 9 shows the earlier tree solved for all of its compound probabilities (these are to the right of the TOTAL awards, following "P = ").

Knowing the compound probability of each scenario permits us to calculate the expected value of all the scenarios. This is done by multiplying each of the total awards by its respective compound probability, and summing the results. On the tree in Figure 9, it is shown just to the right of the LITIGATE branch.[10]

---

[10] All of these computations were performed in a fraction of a second using an off-the-shelf decision tree software program called DATA™. This program also generated all of the dependency diagrams, decision trees, and graphs found in earlier and later sections of this Chapter. For more information, including a software manual written especially for attorneys, please call 707/833-1093.
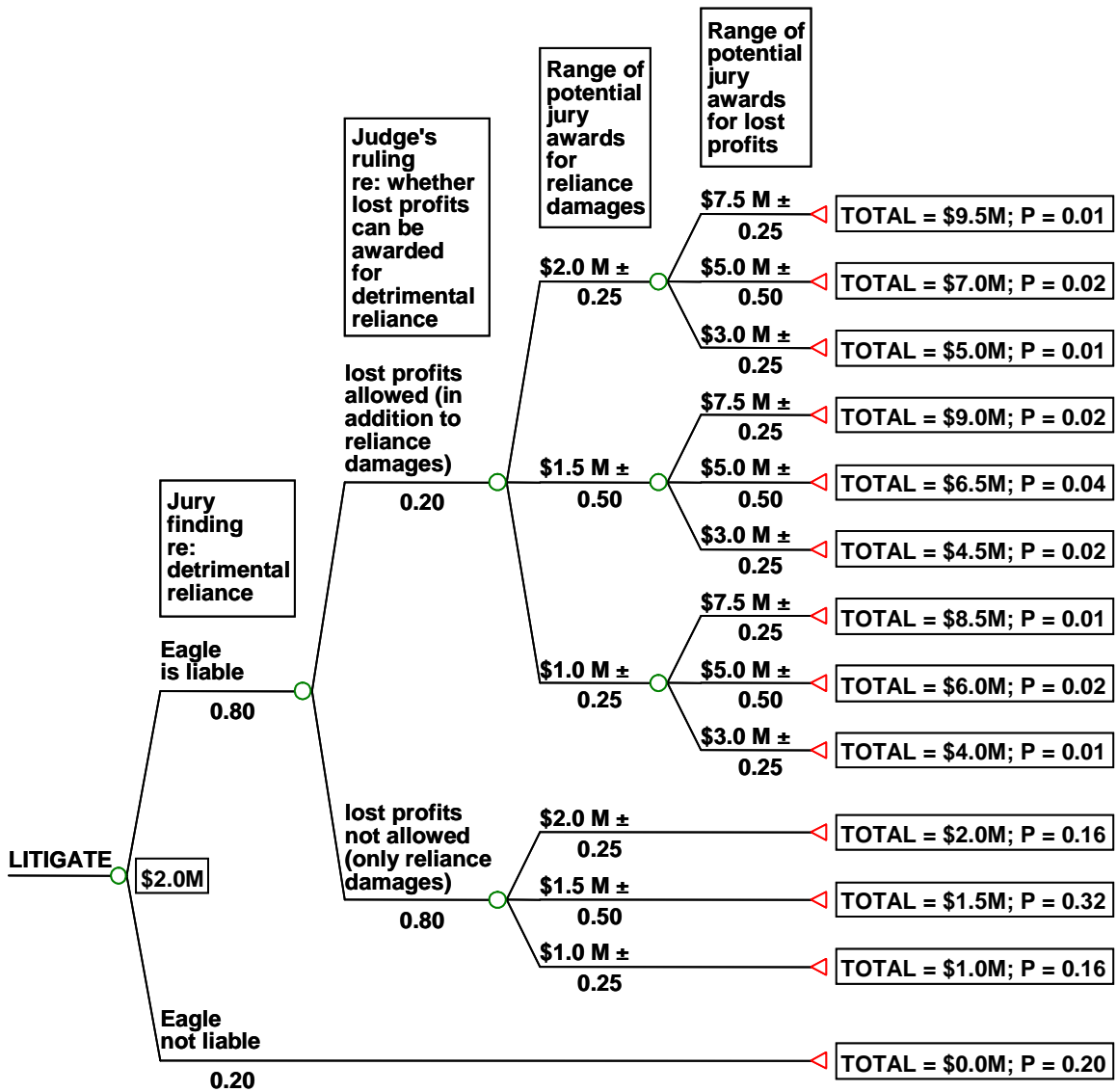
Figure content — decision tree:

Jury finding re: detrimental reliance

LITIGATE — $2.0M

- **Eagle is liable** — 0.80
  - **Judge's ruling re: whether lost profits can be awarded for detrimental reliance**
    - **lost profits allowed (in addition to reliance damages)** — 0.20
      - **Range of potential jury awards for reliance damages**
        - **$2.0 M ± 0.25**
          - **Range of potential jury awards for lost profits**
            - **$7.5 M ± 0.25** → TOTAL = $9.5M; P = 0.01
            - **$5.0 M ± 0.50** → TOTAL = $7.0M; P = 0.02
            - **$3.0 M ± 0.25** → TOTAL = $5.0M; P = 0.01
        - **$1.5 M ± 0.50**
            - **$7.5 M ± 0.25** → TOTAL = $9.0M; P = 0.02
            - **$5.0 M ± 0.50** → TOTAL = $6.5M; P = 0.04
            - **$3.0 M ± 0.25** → TOTAL = $4.5M; P = 0.02
        - **$1.0 M ± 0.25**
            - **$7.5 M ± 0.25** → TOTAL = $8.5M; P = 0.01
            - **$5.0 M ± 0.50** → TOTAL = $6.0M; P = 0.02
            - **$3.0 M ± 0.25** → TOTAL = $4.0M; P = 0.01
    - **lost profits not allowed (only reliance damages)** — 0.80
        - **$2.0 M ± 0.25** → TOTAL = $2.0M; P = 0.16
        - **$1.5 M ± 0.50** → TOTAL = $1.5M; P = 0.32
        - **$1.0 M ± 0.25** → TOTAL = $1.0M; P = 0.16
- **Eagle not liable** — 0.20 → TOTAL = $0.0M; P = 0.20

FIGURE 9. SOLVED DECISION TREE
— Showing Compound Probabilities and Expected Value —

14

How should the expected value be used? If your client can afford to "play the averages" given the range of dollars at risk in the case, the expected value is usually considered to be the most a defendant should pay to settle and the least a plaintiff should accept.[11] This is because it is well-recognized that making decisions based on the expected value will maximize one's wealth over time.[12] This does *not* mean that if Sparrow refuses to settle for less than $4 million, for example, and Eagle rejects this demand (as excessive in light of the $2 million expected value) and proceeds through trial, that Eagle will necessarily be hit with a verdict of less than $4 million (any more than it means that if Eagle's exploration group did a risk analysis of whether to drill for oil in a given location, and the analysis resulted in an expected value of $100 million, Eagle would be assured of striking at least $100 million of oil). In any single uncertain venture, one could do better *or* worse than the expected value. However, assuming that Eagle's legal and business advisors can realistically assess uncertainty in their respective fields of expertise, by always selecting the alternative with the best expected value, Eagle will maximize its wealth over its entire portfolio of risky ventures.

§12:22   — Potential adjustments to the expected value: Litigation costs

The expected value can be adjusted to reflect your costs of continuing with litigation — both the external costs of outside counsel and expert witnesses, the internal costs of in-house counsel, and the opportunity costs of management involvement. If the costs themselves are substantial and highly uncertain, they can be the subject of a decision tree analysis, just as the potential verdicts were. Costs would be added to the expected value when you are the defendant, and subtracted from the expected value when you are the plaintiff. Only costs that have yet to be incurred should be counted; those that have already been "sunk" cannot effect the relative value of continuing to litigate versus stopping and settling (unless they are recoverable from the other party as part of a judgment in your favor).

Although it is possible to do so, it is not a requirement that the expected value be adjusted to reflect your costs. Defendants will frequently not want to do so in situations where plaintiff has a very weak case on the merits and there is a significant risk of encouraging a number of additional frivolous — but costly — suits if the case is settled for an amount greater than the expected value *exclusive* of costs. Looking at the broad picture, this can make the most economic sense, even though looking at just the one suit, it might be more profitable to settle than to continue to incur pretrial and trial costs. Where counsel suspects that this might be the case,[13] a risk analysis of this broader problem should be performed, as outlined in Section 12:24, *infra*.

[11] The effect of litigation costs and other factors are discussed in §§12:22–12:24, *infra*.

[12] For example, Spurr and Bonini write: "If the decision maker follows the criterion of maximizing expected monetary value in each [situation], he will be better off, on the average, than using any other decision criterion. In this context, maximizing expected value can be thought of as maximizing average payoff over a number of different situations." Spurr, William A. and Bonini, Charles P., Statistical Analysis for Business Decisions 169 (Richard D. Irwin, Inc. 1973).

[13] *See supra* § 12:13.

§12:23 — Potential adjustments to the expected value: Willingness and ability to take risk

In cases where the dollars at stake represent a significant percentage of a client's net worth, the client might not want to "play the averages" by using the expected value as its decision criterion. Whether or not to make an adjustment because of risk aversion (or risk tolerance) is the *client's* decision — not the attorney's. To facilitate the client's decision making process, it is most helpful to summarize all of the scenarios of the tree in a *probability distribution bar chart,* such as shown in Figure 10.

IF LITIGATE
Swallow v. Eagle

Expected Value of Litigating = $2M
Probability of Defense Verdict = 20%
Prob. of Verdict $1M to $2M = 64%
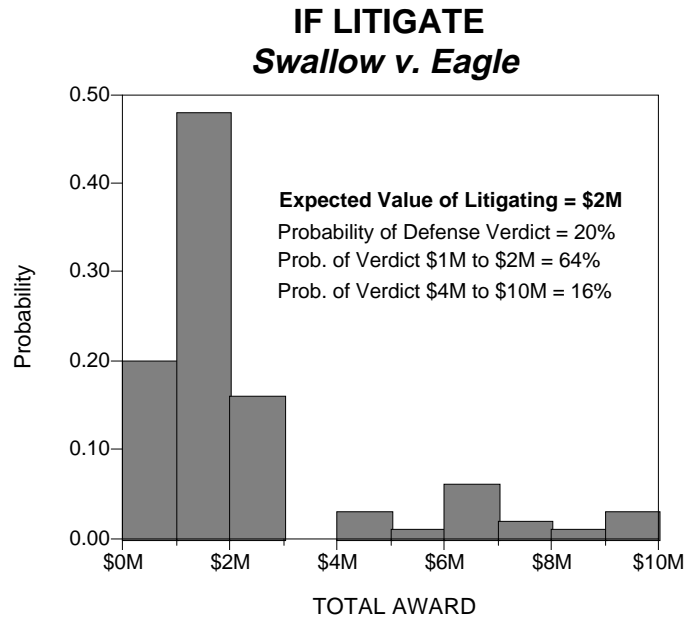Prob. of Verdict $4M to $10M = 16%

FIGURE 10. PROBABILITY DISTRIBUTION BAR CHART
— Showing Range and Likelihood of Potential Litigation Outcomes —

§12:24 — Potential adjustments to the expected value: Impact on other litigation or on other business

Concerns about the effect of a trial or a settlement on other litigation (existing or potential) or on the client's business and operations can be dealt with either *explicitly* or *implicitly*. An explicit analysis of these concerns would consist of (1) capturing the key uncertainties (such as the number and cost of additional lawsuits, or the impact on market share or production costs) and their dollar consequences in dependency diagrams and then decision trees, (2) brainstorming how each could be resolved favorably or unfavorably on lists of reasons, (3) quantifying them with probabilities or high-middle-low ranges as appropriate, and (4) calculating their expected values.

An implicit analysis of these concerns would entail thinking less formally about whether they are enough to tip the scales from litigation to settlement or vice-versa. For example, if Sparrow insists on $3 million to settle a case for which you have calculated a litigation expected value of only $2 million, can you imagine that rejecting the settlement will have an impact on other aspects of Eagle's business of more than $1 million? If so, the scales would tip from litigation being the better strategy to settlement making more sense overall. Or can you imagine that litigating and losing will have an impact on lost sales (or future lawsuits) of more than $1.25 million *relative to* the impact of settling for $3 million?[14] If so, then once again the better choice would be to settle.

[14] Because the chance of Eagle losing the detrimental reliance case to Sparrow is 80%, the relative impact of losing compared to settling would have to exceed $1.25 million — not just $1.0 million — to make the total expected value of litigating greater than the $3 million settlement demand: $2 million expected value of litigation + (80%×$1.25 million) expected value of relative impact if lose = $3 million.

§ 12:25   — Cost-benefit analysis using sensitivity analyses

Not only can decision tree analysis be used to make "big picture" decisions such as do we litigate or do we settle, it can also be used to make a myriad of tactical decisions that lawyers constantly face. Consider two examples. *Question 1:* Is it worth spending an additional $200,000 in discovery to try to reduce the chance of being held liable from 80% to 60%? *Question 2:* Are you better off trying to improve by 10 percentage points the chance of getting a defense verdict *or* the chance of having the judge rule that plaintiff is only entitled to its reliance damages and not its lost profits?

These kinds of cost-benefit decisions are easily made with the help of *sensitivity analyses.* The graphs in Figure 11 show how the expected value of litigating changes with changes in the probabilities of Eagle being found liable (top graph) and the judge ruling that lost profits can be awarded in addition to reliance damages (bottom graph). As regards Question 1, the top graph shows that every 10 percentage point change in probability changes the expected value of litigating by $250,000, since the value swings from $0 at 0% to $2.5 million at 100%.[15] Thus, a 20 percentage point improvement (from 80% chance of losing to 60%) would be worth $500,000,[16] and a decision to spend an additional $200,000 on discovery would be cost-justified so long as you thought you had *at least* a 40% chance of being able to improve your chance of winning by these 20 percentage points.[17]

As regards Question 2, the bottom graph shows that every 10 percentage point change in that probability changes the expected value by over $400,000 (since the value swings from somewhat more than $1 million at 0% to in excess of $5 million at 100%). Therefore, the more cost-effective use of counsel's time (and the client's money) would be to improve the probability on the lost profits legal issue.

An additional use of these sensitivity analysis graphs is to give counsel more confidence in making its "litigate or settle?" decisions. Let's say you are very sure that Sparrow won't reduce its settlement demand below $3 million, but you are not so sure about how realistically you have assessed your chance of being found liable. Perhaps the deck is stacked even more seriously against you than the 80/20 probability you assessed. The top graph shows that $3 million is too much to pay in settlement *even if the chance of liability being found were 100%.* In contrast, however, if you are uncomfortable about the 20% probability assessed on the judge permitting the jury to award lost profits, you might well want to do more research on that issue: if a more realistic probability would be 45% or higher (as indicated by the dotted line), the expected value of litigating would jump above $3 million, making settlement the better option.

---

[15] In other words, if the probability under the branch "Eagle is liable" in Figure 9, *supra*, were changed from 0.80 to 0.00, the expected value would fall to $0 (since a defense verdict was now a certainty). Similarly, if this probability were increased from 0.80 to 1.00, the expected value — based on the revised compound probabilities of each of the scenarios and the resulting probability-weighted average — would be $2.5 million.

[16] 20% × $2.5 million = $500,000.

[17] This is true because 40% × $500,000 improvement = $200,000. Note that the decision to spend $200,000 would also be cost-justified if you thought you had at least an 80% chance of at least a 10 percentage point improvement (because 80% × $250,000 improvement = $200,000).

Sensitivity Analysis on
Jury Finds Eagle IS Liable (Detrimental Reliance)
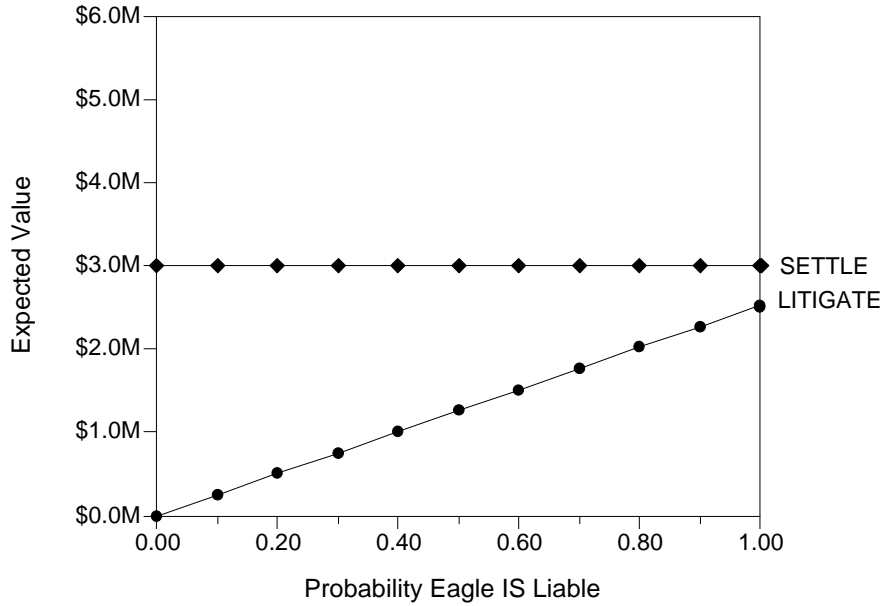
Sensitivity Analysis on
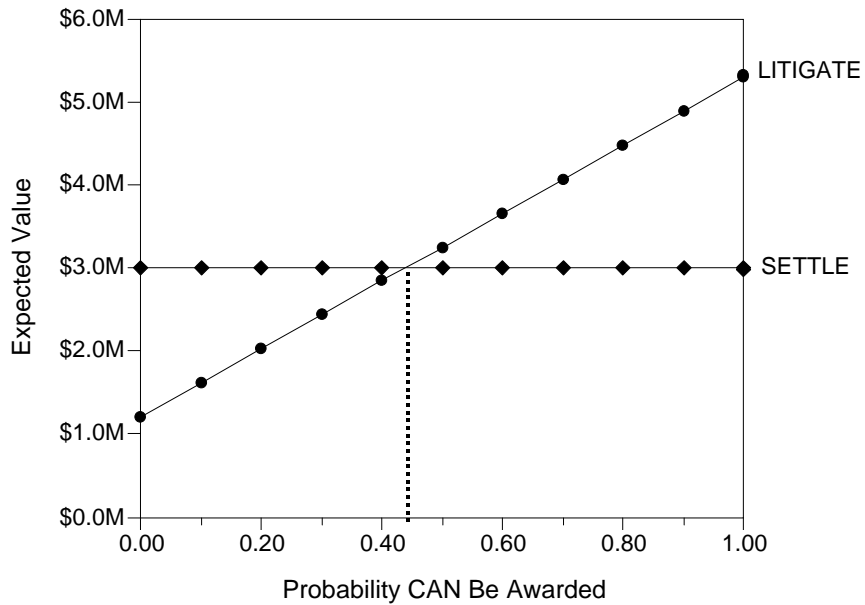## Judge Rules Lost Profits CAN Be Awarded

FIGURE 11. TWO SENSITIVITY ANALYSIS GRAPHS
— Showing Impact on Expected Value of Changing Probabilities —

§ 12:26   Benefits to the corporate law department of using decision tree analysis

The benefits of a corporate law department using decision tree analysis are many. First, it provides a framework for identifying the issues, both legal and factual; the potential exposure or recovery (depending on whether the corporation is the defendant or plaintiff); and the probabilities associated with those questions. Decision tree analysis thereby provides a quantitative model of the problem and identifies the factors determinative of the outcome of the dispute. Second, decision tree analysis improves the quality of the evaluation by making the process transparent, and is the basis for communication and review by outside counsel and other in-house counsel. It provides an important filter that helps identify matters with significant risk that might otherwise not be appreciated. The potential damages in a case that is perceived to be a "sure winner" may not receive attention in an intuitive evaluation of a case. This can lead to an unpleasant surprise. A quantitative evaluation will identify those damages, and incorporate that risk in the overall analysis. It will also assist the attorney in ensuring that the client is fully informed of the "high side" risk posed by the case.

In the final analysis, quantitative decision tree analysis improves the quality and value of the product, *i.e.*, legal service, and makes the service provider more valuable to the organization.

§ 12:27   Benefits to the business client of using decision tree analysis

One of the primary benefits of using decision tree analysis is the ease and clarity with which the issues, risks and probabilities of prevailing are communicated to the business client. The decision tree analysis is in a format and a quantitative language that the business client will understand. With an increased understanding of the factors influencing the outcome of the litigation and the range of possible outcomes, the business client is able to make a more informed judgment regarding the matter — *e.g.,* in litigation whether to settle or not — and often, to make this decision earlier in the life of the dispute. It also provides a useful means by which the attorney and the business client can discuss the degree of risk and potential exposure the client is prepared to tolerate. Finally, a formal, clear and logical process increases the client's confidence that the case has been thoroughly and professionally evaluated.

§ 12:28   Benefits to outside counsel of using decision tree analysis

Outside counsel will reap numerous benefits from using decision tree analysis. One of the foremost benefits of using the methodology is that it forces litigation counsel to assess the risks of pursuing various factual and legal theories in the case. By requiring counsel to assess the probabilities of these alternatives, decision tree analysis provides a rational basis for determining the most important issues in a case. The identification of a unifying theme is critical in all cases, but particularly so in complex cases. The time and energy that might otherwise be wasted in the pursuit of tangentially important alternatives can be greatly reduced.

For outside counsel, decision tree analysis can be used as an on-going tool for refining and crystallizing the issues in a case. As new information is developed, the tree can be expanded, even into sub-trees, to take into account the additional alternatives. If employed at the outset and updated as significant new information is learned, decision tree analysis can focus discovery on the right issues and further the use of resources in a more productive manner.

The clarity that decision tree analysis can provide is useful to all outside counsel, not just litigators. In business transactions and virtually any other legal problem, the disciplined consideration of the alternatives and costs of pursuing those alternatives will be of value. Outside counsel will then be able to communicate that added value to the client. This capability is significant in differentiating oneself from the competition. Outside counsel will also benefit from the collaboration the decision tree analysis fosters. The client will necessarily be clearer as to the objectives sought, and both inside and outside counsel will have a framework with which to discuss the alternatives and issues. This collaboration will greatly enhance the ability of both to achieve a favorable outcome.