



*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

**MAKING DECISIONS IN TURBULENT  
TIMES: AN ANALYTICAL FRAMEWORK  
AND DECISION TOOLS**

by

Maud Roucan-Kane, Michael Boehlje,  
Allan Gray, Jay Akridge

Working Paper #10-09

November 2010

**Department of Agricultural Economics**

**Purdue University**

*It is the policy of Purdue University that all persons have equal opportunity and access to its educational programs, services, activities, and facilities without regard to race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability or status as a veteran. Purdue University is an Affirmative Action institution.*

# **MAKING DECISIONS IN TURBULENT TIMES: AN ANALYTICAL FRAMEWORK AND DECISION TOOLS**

by

Maud Roucan-Kane Michael Boehlje, Allan Gray  
Department of Agricultural Economics, Purdue University

Jay Akridge

Dean of the College of Agriculture, Purdue University  
West Lafayette, IN 47907-2056

[mrr017@shsu.edu](mailto:mrr017@shsu.edu), [boehljem@purdue.edu](mailto:boehljem@purdue.edu), [gray@purdue.edu](mailto:gray@purdue.edu), [akridge@purdue.edu](mailto:akridge@purdue.edu)

Working Paper # 10-09

November 2010

## **Abstract**

The business climate for the agricultural sector is characterized by increased uncertainty and “unanticipated surprises,” such as new government regulations, new technology and product introductions, mergers and acquisitions, nonperformance by supply chain partners, and changes in interest and exchange rates. This manuscript uses a real case problem to describe a set of tools (such as scenario analysis, risk scorecarding and heat mapping, payoff matrices, decision trees, and options portfolio mapping) available to use for making strategic decisions in such a business climate.

Keywords: Scorecarding and heat mapping, decision trees, scenario analysis, payoff matrices, real options

JEL Codes: Q13

Copyright © by Maud Roucan-Kane, Michael Boehlje, Allan Gray, and Jay Akridge. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

# **Making Decisions in Turbulent Times: An Analytical Framework and Decision Tools**

## **Executive Summary**

The business climate for the agricultural sector is characterized by increased uncertainty and “unanticipated surprises,” such as new government regulations, new technology and product introductions, mergers and acquisitions, nonperformance by supply chain partners, and changes in interest and exchange rates. Strategic decision making in a business climate characterized by such risk and uncertainty is difficult at best. But there are a set of tools (such as scenario analysis, risk scorecarding and heat mapping, payoff matrices, decision trees, and options portfolio mapping) available to frame such decisions to enhance the quality of the decision making process. The purpose of this manuscript is to describe these tools and illustrate their application. The discussion is not just a tutorial on tools that can be used in analyzing risky decisions, it illustrates their practical use through application to a real case problem. The ultimate goal of this manuscript is to demonstrate the pragmatic application of these tools so as to facilitate their use by business decision makers, as well as educating others on these the tools.

# **Making Decisions in Turbulent Times: An Analytical Framework and Decision Tools**

## **Abstract**

The business climate for the agricultural sector is characterized by increased uncertainty and “unanticipated surprises,” such as new government regulations, new technology and product introductions, mergers and acquisitions, nonperformance by supply chain partners, and changes in interest and exchange rates. This manuscript uses a real case problem to describe a set of tools (such as scenario analysis, risk scorecarding and heat mapping, payoff matrices, decision trees, and options portfolio mapping) available to use for making strategic decisions in such a business climate.

## **Keywords**

Scorecarding and heat mapping, decision trees, scenario analysis, payoff matrices, real options

## Tools and Analytical Framework to Make Decisions in Turbulent Times

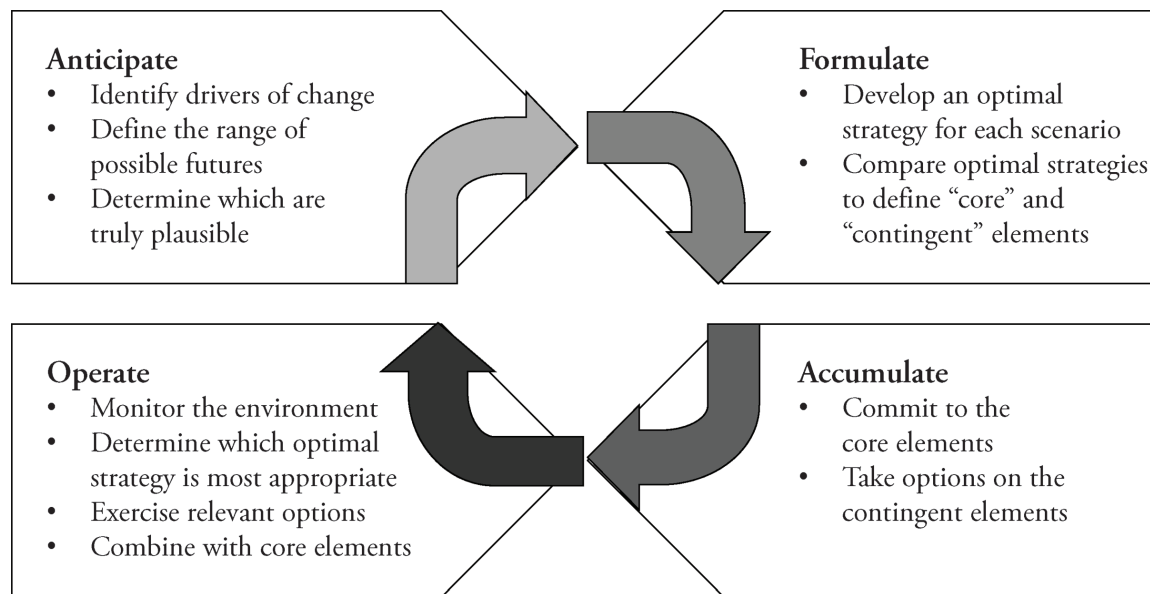
The business climate for all stages of the value chain for the agricultural sector is increasingly characterized not just by increased risk, but by shocks or “unanticipated surprises.” Volatility in prices and costs are not new, but the magnitude and speed of changes is unprecedented as evidenced by recent fluctuations in grain and fertilizer prices. Furthermore, and more importantly, the types and sources of risks and uncertainties faced by agribusiness decision makers have exploded in recent times—“unanticipated surprises” resulting from changes in government policy and regulation, new technology and products introduced into the market that challenge current offerings, mergers and acquisitions that change the competitive landscape, nonperformance by supply chain partners resulting in counterparty risk, changes in interest rates or foreign exchange rates, etc.

Strategic decision making in a business climate characterized by such risk and uncertainty is difficult at best. But there are a set of tools available to frame such decisions, which enhances the quality of the decision-making process. The purpose of this manuscript is to describe these tools and illustrate their application. The discussion is not just a tutorial on tools that can be used in analyzing risky decisions. Instead, it illustrates their use through applications to a real case problem. The ultimate goal of this manuscript is to demonstrate the pragmatic application of these tools so as to facilitate their use by business decision makers, as well as educating others of these tools.

### The Strategic Framework

Raynor provides a useful framework to structure strategic decision making in an uncertain environment. Raynor, in his book *The Strategy Paradox*, argues that for companies to succeed in an unpredictable future, they must develop practical strategies based on multiple choices that respond to the requirements of different possible futures rather than on a single strategic commitment. He suggests that the key to such decisions is strategic flexibility, and the decision process involves four steps—anticipate, formulate, accumulate, and operate (see Figure 1). Anticipation involves identifying the drivers of change or the forces that are shaping the future, identifying the range of possible futures, and deciding which futures are plausible or have the highest chances of actually occurring. The formulation step includes developing an optimal strategy for each scenario, and identifying the “core” or common elements and the “contingent” or unique elements of these strategies. The accumulation step includes the decision to commit to the core elements of a strategy and take options on the contingent elements. Finally, in the operations step, managers implement and monitor the strategic choices, including exercising appropriate options.

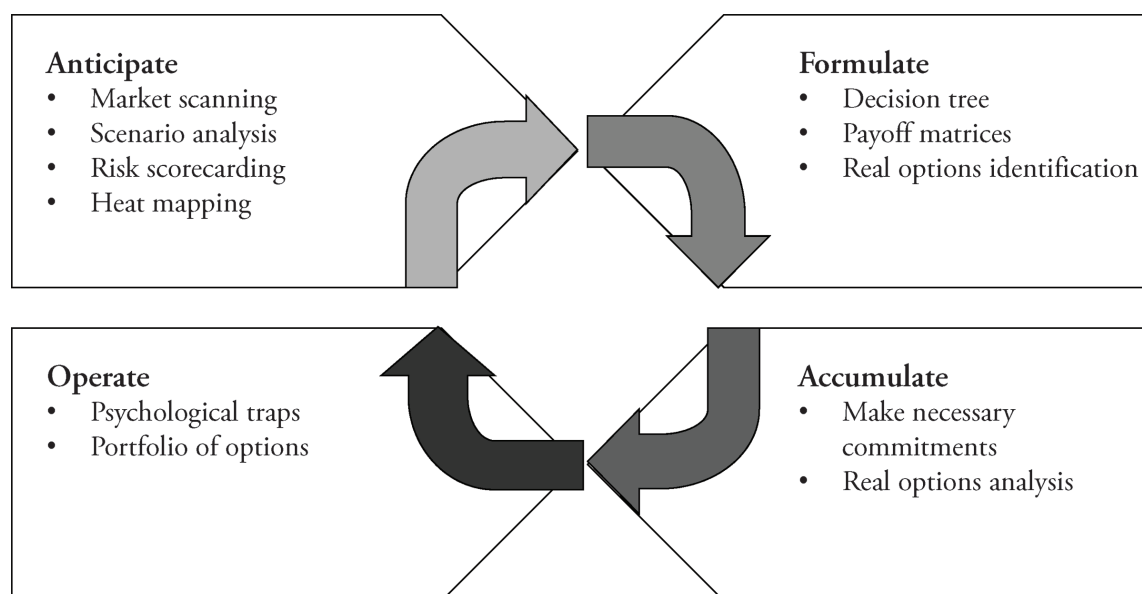
**Figure 1. Strategic Flexibility**



Source: Raynor (2007)

To apply Raynor’s four steps, we propose a series of tools as summarized in Figure 2. Our discussion of the tools will follow. For example, the tools used in the anticipation step are market scanning, scenario analysis, risk scorecarding, and heat mapping. The decision tools for formulation are decision trees, payoff matrices, and real options thinking. For the accumulation step, the tools used are making commitments and a more complete and comprehensive real options analysis. Finally, the tools useful for the operations step include psychological traps and structuring a portfolio of options.

**Figure 2. Strategic Flexibility/Tools for Decision Making**



Source: Adapted from Raynor (2007)

## **An Application: The Excel Cooperative Case**

The methodology and tools presented here have been tested and used in executive education courses. Students/participants are challenged to conduct an analysis of the strategic issues and key uncertainties facing a company—Excel Cooperative. Excel is a retail grain/input supply cooperative that is assessing how to respond to the expanding ethanol market. Using scenario analysis, the participants determine how the uncertainties may unfold. Building on this analysis, they score and map the uncertainties and decide which uncertainties to capitalize on and which projects should be pursued to exploit those uncertainties. As a follow-up to the scenario analysis, participants use payoff matrices to further analyze Excel's choice. They use the results of the payoff matrices to draw a decision tree for Excel. The authors then introduce real options concepts and ask participants to alter their decision tree to reflect a growth or delay option. Finally, participants use options portfolio mapping to further evaluate the different projects Excel should pursue.

### **Excel Cooperative<sup>1</sup>**

Excel Cooperative is a mid-sized, “local,” and farmer-owned cooperative serving producers in north central Indiana. The diversified organization sells crop inputs and provides a range of agronomic services; sells and delivers energy inputs (diesel fuel, gasoline, etc.); manufactures feed and manages a pork production business; and stores and markets grain. The well-run cooperative has been profitable and enjoys a large market share in its primary geographic market.

Excel Cooperative is located in one of Indiana's most productive corn-growing regions. Hence, it is a hotbed of ethanol activity. Four ethanol plants are operating, under construction, or planned, and the announcement of a fifth plant (VeraSun) is expected any day. The massive expansion in corn processing capacity affects each of Excel's four divisions: agronomy, energy, grain, and feed and livestock.

### **Agronomy Division**

The agronomy division of Excel Cooperative has three branches that offer a complete line of crop production inputs to area growers: herbicides, insecticides, fungicides; custom application of liquid and dry fertilizers and chemicals; soil sampling; and corn, soybean, wheat, and legume seeds. The organization offers precision or site-specific services such as soil sampling with GIS and variable rate

<sup>1</sup>A more complete discussion of the Excel Cooperative case can be found in: Akridge, J., M. Roucan-Kane, A. Gray, M. Boehlje, C. Bitsanis. *International Agribusiness Strategy Cases: A Book in Honor of Professor Ray Goldberg*. M.A. Boland and E. Gallo. “Excel Cooperative: Strategic Response to the Boom in Ethanol.” K-State Printing Services, Manhattan, Kansas, 2009.



application (VRT) of fertilizer and lime. Excel is still evaluating its overall approach to precision services, hence revenue and profit contributions from precision services are still modest. Excel's sales of plant nutrients have been relatively steady in recent years. Crop protection chemical volumes and margins have declined due in part to biotechnology advances and seed varieties with "input traits" that require lower levels of (and lower cost) pesticides and herbicides. Custom application revenues have held up. Looking longer term, the additional corn acres driven by growth in biofuel production could be a real boost for Excel's agronomy business. In fiscal 2006, agronomy division sales were \$16.9 million, accounting for 19 percent of total Excel sales and 10 percent of the cooperative's net operating income. Although, competition in the Excel market is intense, Excel is the market leader in one of its counties, with a market share of 50 percent.

## **Energy Division**

The energy division offers several locations with farm and home delivery of diesel fuel, LP gas, and gasoline. For fiscal 2006, the energy division's sales were \$24.6 million, 28 percent of total Excel sales. Net operating income from the energy division represented 30 percent of the total in fiscal 2006. Excel holds more than 80 percent of the market in liquid fuels for on-farm use in its trade territory and has a strong presence in bulk commercial fuels.

## **Grain Division**

Excel owns a total of 4.9 million bushels of grain storage over several locations and is currently adding another 700,000 bushel storage facility. Excel also has capacity to ship unit train rail car loads. In total, Excel markets between 10 and 11 million bushels of grain each year—about 2.0 to 2.5 million bushels of soybeans, and the rest corn. In fiscal 2006, grain accounted for 35 percent of the cooperative's sales volume and 23 percent of its net operating income. Currently, most of its grain is shipped to North Carolina, South Carolina, and Georgia in 65-car unit trains, where it is primarily used as hog and poultry feed. The other major market is Lafayette, Indiana, for the two Tate & Lyle corn-processing plants. Excel Cooperative has two large grain competitors and several smaller ones in their market territory.

## **Feed and Livestock Division**

Excel Cooperative works with individual pork producers in the contract production of hogs, producing 75,000 hogs annually. In addition, Excel mills produce feed for another 125,000 hogs. The cooperative has two contract nursery sites and numerous contract finishing facilities. Excel mills about 60,000 tons of feed annually through its two mills. While growth has slowed, the pork production business does continue to expand in the Excel trade area as integrators look for low-cost

sources of corn and low transportation costs to the two large pork-processing facilities nearby. Excel's biggest competitor produces hogs all over Northern Indiana and feeds a total of about 200,000 hogs annually. In addition, there are two farmer/integrators that have feed-milling capacity and feed about 125,000 hogs annually. In total, there are at least 650,000 hogs in the area.

## **The Analytical Tools**

Making decisions in turbulent times requires systematic analysis. We propose a four-step approach:

1. Market scanning, uncertainty scorecarding, and heat mapping: The market is evaluated as to fundamental drivers, and then the uncertainties are listed, scored, and mapped to determine which are the most critical in shaping how the company should capitalize on the uncertainty.
2. Scenario analysis: Potential uncertainties are identified and a set of plausible strategies are suggested. This description should show which action should be taken under each scenario.
3. Payoff matrices and decision trees: The scenarios can be summarized in a payoff matrix or a decision tree. The profit and probability associated with each scenario and project will determine which decision should be made—which projects to pursue or not. The calculation of profits should take into account the valuation of real options.
4. Options identification and portfolio mapping: Once a list of feasible projects is put together, one needs to evaluate the portfolio and make sure the risk is diversified among projects. Portfolio mapping would determine whether or not the portfolio is too risky.

A number of concepts and tools are useful in implementing this approach:

- Scenario analysis
- Market scanning
- Risk scorecarding/heat mapping
- Payoff matrices
- Decision trees
- Real options valuation (time delay)
- Options portfolio mapping
- Psychological or decision traps

Each of these will be discussed in turn with direct applications to the Excel Cooperative case.

### *Scenario Analysis*

Scenario analysis consists of analyzing different scenarios of the future based on the uncertainty (i.e., “future-now” thinking). Scenario analysis came into prominence in the 1970s when used to

help Royal Dutch/Shell anticipate the future of the oil industry. Scenarios are specially constructed stories about the future. Usually and preferably, scenarios come in sets—most often groups of three or four—each one modeling a distinct and plausible future world, rather than one likely end-state. They each determine a plausible path the present may take, with one event following another as a necessary consequence (Raynor, 2007; Schoemaker, 1995; Schnaars and Ziamou, 2001; Hammond et al., 1999; Wilkinson; Bristow, 1990).

Scenario analysis is a seven-step decision aid process:

1. Define the Problem/Issue

Defining the issue or problem is best accomplished by considering the following dimensions:

- a. What are the goals/objectives/criteria in the decision?
- b. Specific product markets, geographic areas, and technologies need to be determined.
- c. The time frame to look at depends on the rate of technological change, product lifecycles, elections, competitors' planning horizons, and so forth.
- d. What knowledge would be of greatest value (look at the past)?

2. Identify the Dimensions of Uncertainty

Several dimensions can be looked at: business/operation uncertainty, financial uncertainty, market uncertainty, technological uncertainty, business relationship uncertainty, policy/regulatory uncertainty. Once all the uncertainties have been listed, the key uncertainties must be identified; scorecarding and heat mapping, as will be discussed shortly, assists with this process. The key uncertainties are the ones that are the most crucial to the outcome of any decision. Finally, relationships among these key uncertainties have to be recognized.

3. Determine the Limits of Uncertainty

The boundaries for the uncertainties must be defined: high/low, fast/slow, intense/weak, etc. It is often helpful to be explicit; for example, will a regulatory approval for a new plant take six months or two years?

4. Construct Scenarios

There are three different ways to construct the scenarios:

- a. Intuitively—find major themes and story lines to organize the elements
- b. Heuristically—select the two most important uncertainties and place them in a matrix
- c. Statistically—combine the outcomes of all the key uncertainties into internally consistent strings to provide feasible boundaries

Once the scenarios are constructed, they need to be given a name, and the assumptions need to be stated clearly. Finally, a check for consistency and plausibility needs to be performed. There are three questions to test for internal consistency: 1) Are the trends compatible within the chosen time frame? 2) Do the scenarios combine outcomes of uncertainties that indeed go together? 3) Are the major stakeholders placed in positions they do not like and can change?

#### 5. Identify Potential Strategies

Potential strategies that should be considered and may be implemented depending on which scenario may play out should be identified as a form of contingency planning. A concerted effort should be made to identify a strategy or strategies that are common to all scenarios. These strategies have the potential to be implemented more quickly because they are not dependent on the resolution of the uncertainties. Plus, they can be easily adjusted over time to be more specifically tailored to the scenario that is becoming more likely to occur as more information becomes available. Strategies that are unique or specific to a particular scenario should be identified and logged so that they can be more readily implemented as the uncertainty is resolved and a particular scenario becomes more likely.

#### 6. Determine the Relative Probabilities

In most cases, the relative probabilities of each scenario are not obvious, and in fact, they are frequently equally likely to occur. If there is a high probability that one scenario might occur, it is possible that the most important sources of uncertainty have not been identified. As will be discussed shortly, over time and with additional information, some of the uncertainties will be resolved, and a critical later step is to identify the forces and early indicators that should be monitored to update these probabilities.

#### 7. Track Unfolding Futures

Identifying and monitoring the potential forces and events that will provide early indicators of which scenario might be playing out is critical to making sure the appropriate strategy is implemented in a timely fashion. A procedure for systematically tracking these indicators is essential to scenario planning and should be put in place early in the process. The driving forces used to identify the scenarios in Step 2 should help identify the indicators that should be monitored. Scenarios are not predictions but sets of logically derived connected futures.

Scenario analysis is a process designed to identify robust actions to take today and key early warning signals of critical changes. Scenarios help executives understand the uncertainties that lie before

them, “rehearse” their response to those possible futures, and help them spot the scenario that unfolds early thanks to the warning signs.

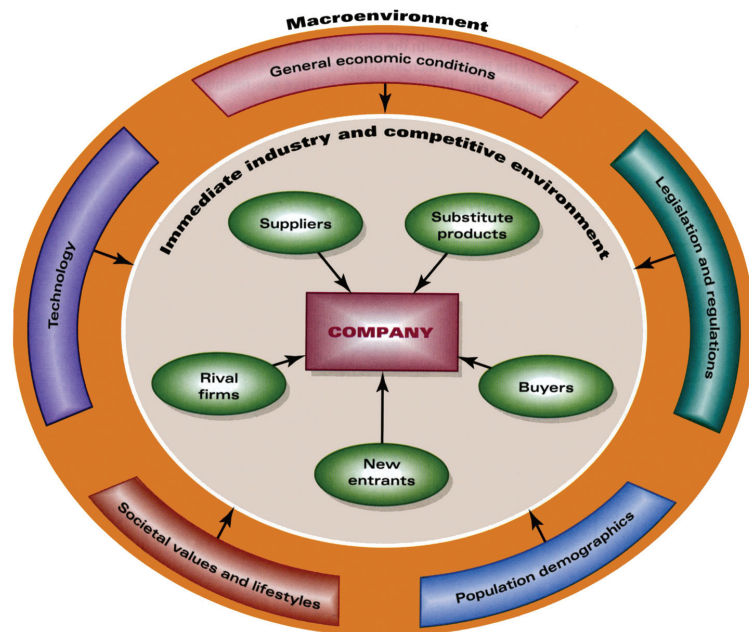
We will apply the scenario analysis tool to the Excel Cooperative case shortly. But to more accurately and easily do so, we will introduce the tools of market scanning, risk scorecarding, and heat mapping as procedures that can be used to identify the most important risks to consider in each scenario.

### *Market Scanning*

Market scanning is a common and well-understood process of assessing the fundamental forces or drivers that are shaping the business climate and specific decision environment facing the firm. Figure 3 provides a useful analytical framework to synthesize the market-scanning process. Note from this framework that the prime purpose (and chief failing) of market scanning is to be comprehensive and complete in identifying the fundamental forces. The subsequent use of heat mapping and scorecarding will assist in prioritizing the forces

and choosing those forces most critical to the decision; the emphasis in market scanning should be to make sure the list of forces is complete to reduce the chances of “unanticipated surprises.”

**Figure 3: The Components of a Company’s Macroenvironment**



Source: Thompson, Gamble, and Strickland (2004)

### *Risk Scorecarding/Heat Mapping*

The purpose of scorecarding and heat mapping is to use a mental model that frames assessment of uncertainty from both a potential and an exposure perspective. Scorecarding consists of taking qualitative discussions about strategic uncertainty and turning these discussions into quantitative rankings. Heat mapping takes the rankings from scorecarding and utilizes both colors/symbols and generic strategies to communicate the impact of the uncertainty on the business, which further operationalizes the risk-assessment process. In essence, these mental models are designed to promote and generate discussion around key areas of uncertainty through a systematic framework that directs the firm in selecting an appropriate uncertainty management strategy (Detre et al., 2006).

The first step in assessing uncertainty requires identification of the sources of strategic uncertainty. The second step consists of scoring the uncertainties. Risk and uncertainties can be assessed on four dimensions: potential, exposure, and the likelihood of each. “Potential” is the opportunity that the firm can capture if it takes the risk. If the outcomes of the risk are favorable, the benefits may be a new market, more loyal customers, etc. “Exposure” represents the downside loss if the outcomes of the risk are unfavorable. This may be represented by losses in sales because of lost customers, a tarnished image, as well as financial losses. “Likelihood” is the probability of seeing the potential or the exposure event happen (Detre et al., 2006).

Most of the time, companies emphasize exposure management. The inclusion of potential is important in the sense that it affects project prioritization in assessing and managing the uncertainty. When only looking at the exposure measure, decision-makers are likely to want to avoid some uncertainties at all cost; but with the inclusion of the potential, it becomes clearer that taking risk can be rewarded. Examples of potentials and exposures for strategic uncertainties can be found in Detre et al. (2006).

The potential, the likelihood of the potential, the exposure, and the likelihood of the exposure can be scored on a scale of 1 to 5. A 1 indicates that the risk is low, unimportant, has minimal impact, or is highly unlikely. A 5 implies that the risk is high, important, has large impact, or is highly likely. Decision-makers are encouraged to have a team involved in the scoring. Each of the team members should individually score the uncertainty. A team discussion should then take place to build a consensus on the score (Detre et al., 2006). Tables 1 and 2 present a set of suggested categories of uncertainty and scores for the potential and exposure of Excel’s grain division.

Using the scoring of the uncertainty, a generic strategy can be selected. Figure 4 contains Excel’s grain division’s heat map with one or more of six generic strategies for managing the uncertainty identified for each of the 16 quadrants. The generic strategies are capitalize, share, transfer, reduce, avoid, and monitor the uncertainty. These generic strategies serve as a filter for concentrating the firm’s effort on choosing a specific action or set of actions to manage the uncertainty—to simultaneously capture the potential and mitigate the exposure (Detre et al., 2006). From the standpoint of the uncertainty in synergies across divisions, the action graph would suggest for Excel to avoid the uncertainty, i.e., to expand the grain division. From the business operations and market conditions standpoint, the opportunity presented by the uncertainty should be captured and the grain division maybe even expanded. Finally, the potential of a favorable biofuel policy also suggests retaining/expanding the grain division. In conclusion, this mix suggests retaining/expanding the grain division and maybe a joint venture with a current competitor to reduce the risk.

**Table 1. Excel's Grain Division Strategic Uncertainty Assessment Scorecard Potential**

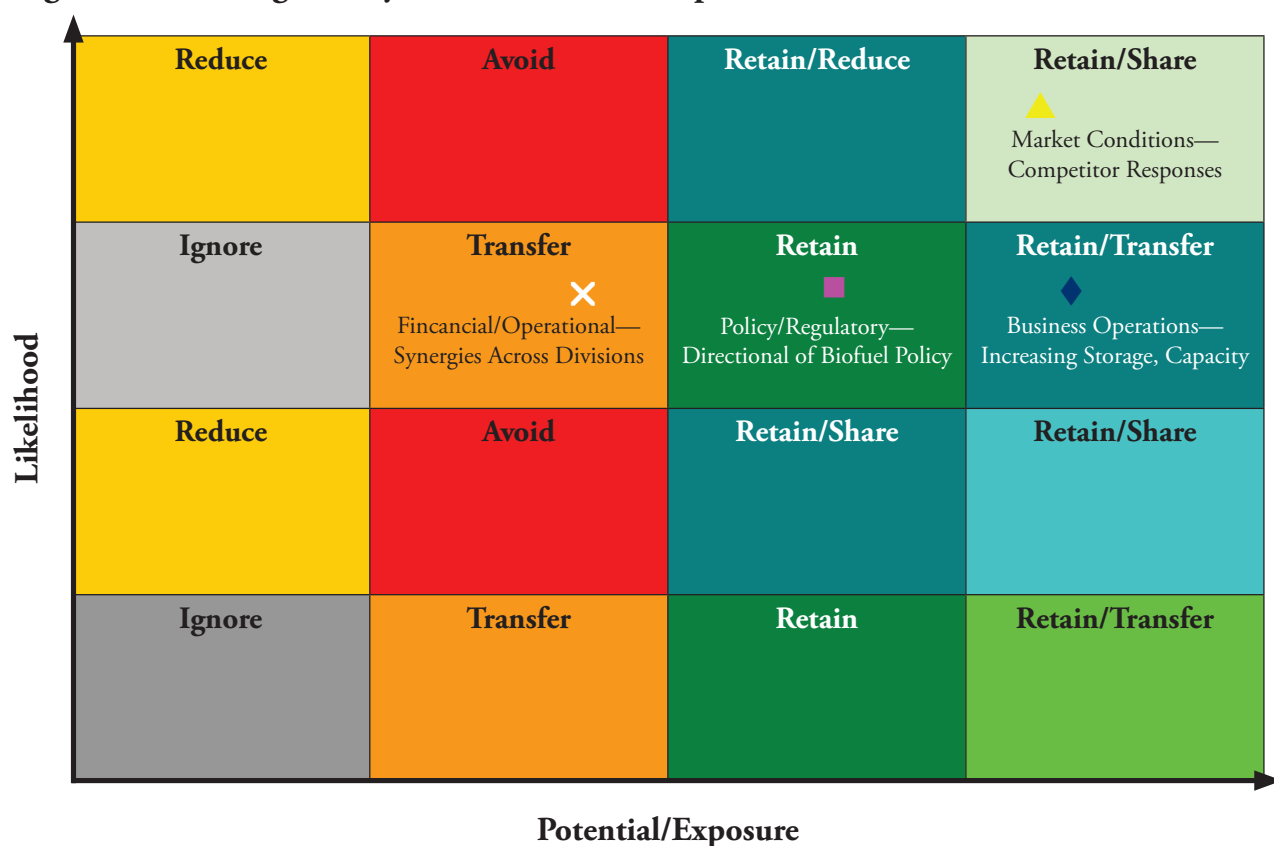
Categories of Uncertainty	Potential		Likelihood	
	Score	Explanation	Score	Explanation
Business Operations— Increasing Storage, Capacity	3	If the demand is significant, this could increase Excel's sales and profits.	3	High likelihood that there will be a greater demand for grain; Low likelihood that the demand will be huge.
Policy/Regulatory— Direction of Biofuel Policy	4	If the biofuel policy is favorable to ethanol, the demand for grain in Excel's area will increase.	5	Extremely likely that the demand for biofuel will be favorable.
Marketing Conditions— Competitor Responses	4	If competitors do not expand, Excel has the potential to significantly increase its business.	4	Highly unlikely that Excel would become a leader or competitive player.
Financial/Operational— Synergies Across Divisions	2	Not much synergy with other Excel divisions even if there is an ethanol boom.	3	Not too likely that good synergies could be developed with the other divisions.

**Table 2. Excel's Grain Division Strategic Uncertainty Assessment Scorecard Exposure**

Categories of Uncertainty	Potential		Likelihood	
	Score	Explanation	Score	Explanation
Business Operations— Increasing Storage, Capacity	3	Excel has not invested too much so far, so the loss would not be too significant.	1	High likelihood that there will be a greater demand for grain, Low likelihood that the demand will be huge.
Policy/Regulatory— Direction of Biofuel Policy	2	Excel has not yet invested in ethanol, so the loss would not be too significant.	1	Extremely likely that the demand for biofuel will be favorable.
Marketing Conditions— Competitor Responses	3	Excel's grain division position is strong, so even significant competitor response would not take all of Excel's customers away.	4	Highly unlikely that Excel would become a leader or competitive player.
Financial/Operational— Synergies Across Divisions	4	Big synergies with other divisions in terms of providing convenience to customers with a one-stop shop.	2	Not too likely that good synergies could be developed with the other divisions.



**Figure 4: Excel's Agronomy Division Action Graph**



A clear conclusion that we can draw from the market scan and risk assessment is that Excel should try to find some way to potentially profit from the ethanol boom. Through the use of scorecarding/heat mapping, two critical uncertainties for the Excel grain division can be identified: 1) VeraSun does or does not build an ethanol plant, and 2) the Southeast grain market continues to source from the Eastern Cornbelt or instead sources from elsewhere. Figure 5 summarizes the resulting scenario matrix and the best decision to implement under each scenario is presented in Figure 6.

One scenario can be labeled “A River of Grain Flow” and includes VeraSun building the ethanol plant and the Southeast grain market continuing to source from Excel. This creates a large demand for grain and requires Excel to obtain additional storage capacity, increase its grain supply, and be able to logistically manage a larger quantity of grain. If Excel can deal with those challenges and be successful, the company would be in a strong financial position.

If VeraSun does not build its ethanol plant, but the Southeast grain marketing continues as is, then it is “Business as Usual,” which means that Excel is still struggling with acquiring enough grain for the feeders, having to compete with ethanol plants. If VeraSun does not build an ethanol plant, Excel could focus more energy on solidifying its relationships with the Southeast feeders.



Figure 5. Scenario Matrix for Excel

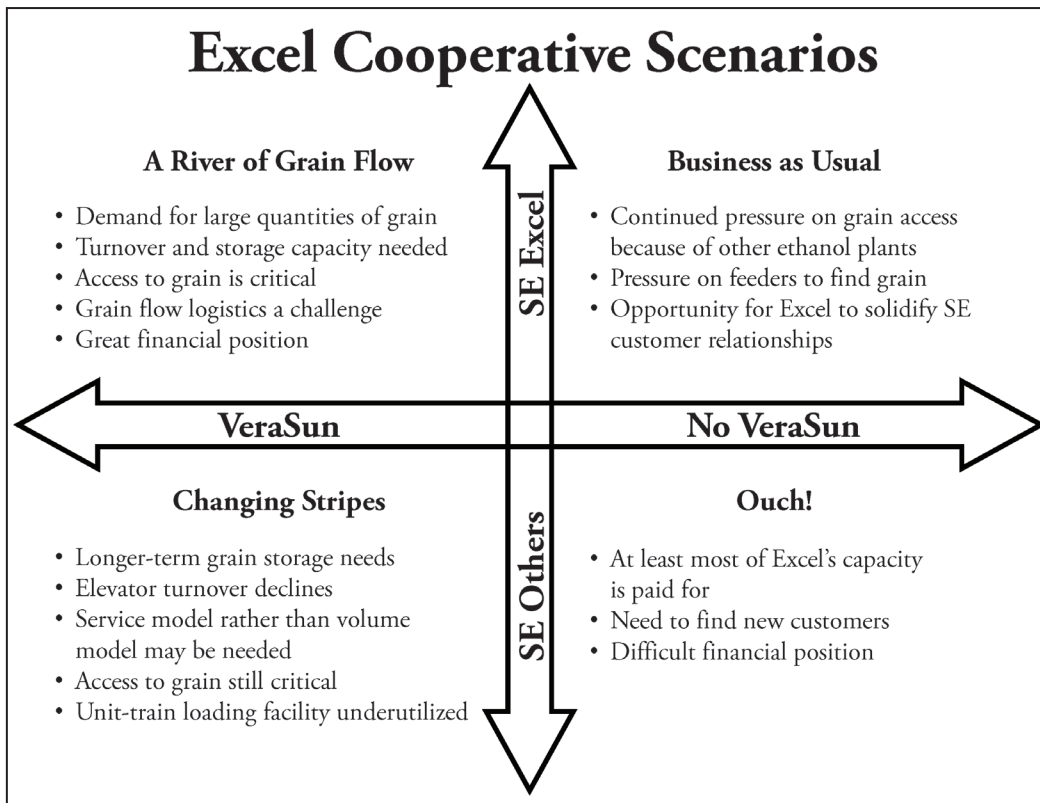
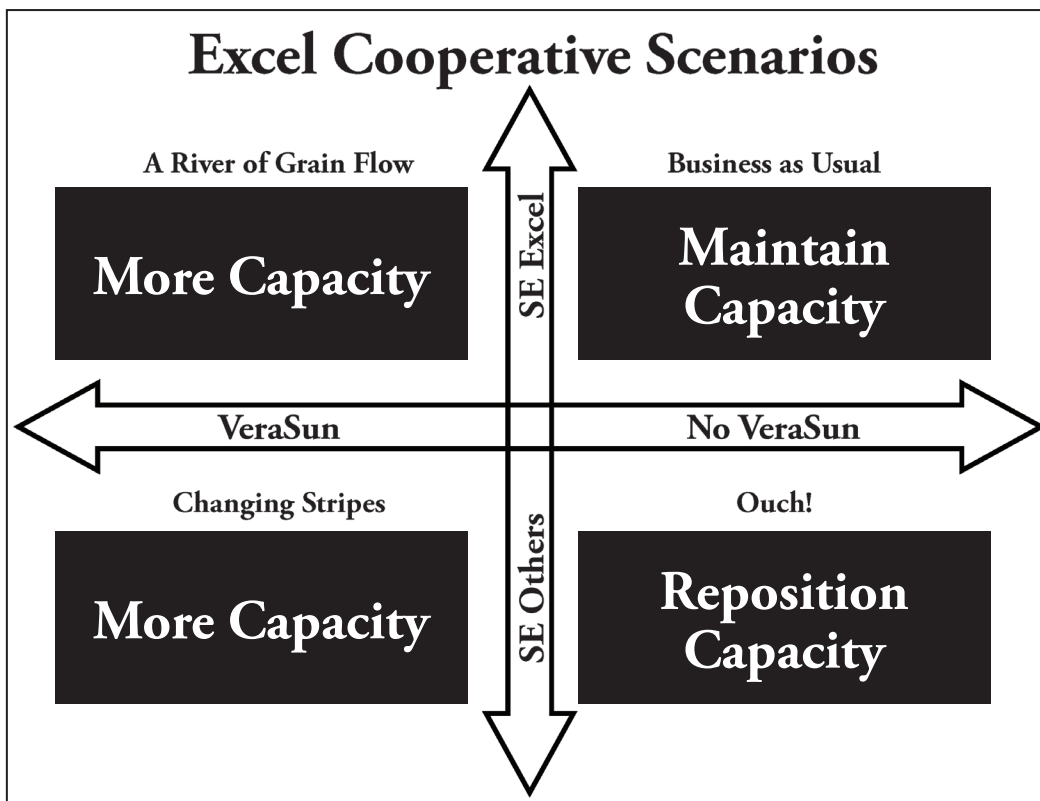


Figure 6. Excel's Best Decision under each Scenario



If the Southeast market decided not to continue its business with Excel, but VeraSun builds its ethanol plant, Excel has to “change its stripes.” To satisfy VeraSun’s growing demand for grain, Excel will likely need to increase its grain-storage capacity and transition from turning its storage capacity frequently to a longer-term storage strategy that includes fewer turns and more local trucking/logistics services.

Finally, the worst-case scenario, “Ouch,” is a combination of the absence of the VeraSun plant and the loss of business with the Southeast feeders. If this happened, Excel at least has most of its capacity paid for, but would still exhibit low income and weak financial performance. For Excel to stay in business, new customers or other sources of income would have to be found as soon as possible.

As indicated earlier, the initial probabilities for each scenario are typically similar, but further analysis and information has the potential to not only alter these initial estimates but also to provide additional details concerning the consequences and implications of the various scenarios. Use of the scenario and scorecarding/heat mapping analyses frameworks not only assists in the identification of the most important risks and the “story” for each, they also guide the investigation to obtain more information.

In the case of Excel Cooperative, an interview with George Green, the CEO, (see Exhibit A) provides additional information that not only improves the estimates of the probabilities for each scenario, but also provides data on the financial consequences for each scenario and strategy combination so that an investment analysis can be completed. Based on the interview information, the scenario-strategy combinations are summarized in Table 3 with their associated probabilities and return (NPV)/loss.

Let’s call the first combination “Acquiring grain more difficult.” In this situation, Excel expands by investing \$2.2 million in additional grain storage and handling capacity (700,000 bushels of additional storage at the South Reynolds plant) to take advantage of the ethanol demand. The market uncertainties are whether VeraSun will build the rumored plant (a 60 percent chance) and how the Southeast (SE) feeders will react. Here, the VeraSun plant is built, and Excel supplies a good portion of the plant’s corn needs. In addition, as a reaction to VeraSun’s plant construction, the Southeast feeders find corn from other markets by aligning with and sourcing from Excel’s competitors (an 80 percent chance), and Excel has to compete aggressively to get the grain. According to the interview, Excel could expect \$192,000 in returns with this scenario.

A second possible scenario-strategy combination is called “Homerun.” Here, Excel also expands and VeraSun builds the rumored plant, but despite the plant’s construction, the Southeast feeders

**Table 3. Summary of the Strategy Sets for Excel**

Title	1st Strategy	Event 1	Probability	Event 2	Probability	NPV (\$1,000s)
Acquiring grain more difficult	Expand elevator	VeraSun	0.6	SE others	0.8	192
Homerun	Expand elevator	VeraSun	0.6	SE Excel	0.2	2,700
Disaster	Expand elevator	No VeraSun	0.4	SE others	0.2	-2,447
At least SE feeders still there	Expand elevator	No VeraSun	0.4	SE Excel	0.8	324
Could be worse	No expansion	VeraSun	0.6	SE others	0.5	-115
Great, if we don't kill ourselves first	No expansion	VeraSun	0.6	SE Excel	0.5	2,079
Ouch	No expansion	No VeraSun	0.4	SE others	0.5	-2,425
Depends on oil prices	No expansion	No VeraSun	0.4	SE Excel	0.5	0

continue to procure most of their grain from Excel (this is less likely, i.e., a 20 percent chance). According to the interview, Excel could expect \$2.7 million in returns from this strategy. A third possibility is called “Disaster.” Excel expands, but the VeraSun plant is not built (40 percent), and in spite of this, the Southeast feeders source their grain from Excel’s competitors (20 percent). According to the interview, Excel could expect a \$2.447 million loss in this case.

A fourth possible scenario-strategy set is called “At least the Southeast feeders are still there.” Excel expands and the VeraSun plant is not built, but the Southeast feeders continue to procure their grain from Excel (80 percent). In this case, Excel could expect a \$324,000 return. A fifth possible combination is called “Could be worse.” Excel does not expand, and the VeraSun plant is built. Excel supplies to the plant, but the Southeast feeders aggressively drive margins down (50 percent). In this case, Excel could expect a \$115,000 loss, according to the interview.

A sixth possible scenario-strategy set is called “Great, if we don’t kill ourselves first.” Excel does not expand, but the VeraSun plant is built and uses Excel as a supplier. Plus, the Southeast feeders

continue to source most of their grain from Excel (50 percent). According to the interview, Excel could expect a \$2.079 million return in this situation.

A seventh possibility is called “Ouch.” Excel does not expand, the VeraSun plant is not built, and the Southeast feeders source their grain from Excel’s competitors. If this scenario occurred, Excel could expect a \$1.963 million loss, according to the interview.

The final possible scenario-strategy combination is called “Depends on oil prices.” Excel does not expand, the VeraSun plant is not built, and the Southeast feeders continue to source most of their grain from Excel. According to the interview, Excel would at least break even in this situation, depending on oil prices. The oil prices directly impact how competitive ethanol prices will be and consequently, the price of grain in Excel’s area.

Excel should closely monitor VeraSun’s plans and extensively communicate with both VeraSun’s executives and the Southeast feeders to obtain indicators of which scenarios in Figures 5 and 6 will unfold. Excel can then update the probabilities in Table 3.

### *Payoff Matrices*

Payoff matrices move risk analysis further from the qualitative evaluation of scenario analysis to a more explicit quantitative assessment. They summarize the payoff associated with each decision and the realization of a specific event (see Table 4). The payoff values for Excel are calculated as the Net Present Value (NPV= present value of future revenue – expenses) of the decision given the realization of a specific event (Hammond, 1999; Brandenburger and Nalebuff, 1995).

Once the payoff matrix is created, a decision can be made. There are several decision rules that can be used to make the decision. The first three methods are non-probabilistic. The maximax decision

**Table 4. Payoff Matrix Template**

	Event A	Event B
Alternative Decision A	Payoff	Payoff
Alternative Decision B	Payoff	Payoff
Alternative Decision C	Payoff	Payoff

rule consists of selecting the alternative decision associated with the maximum payoff. It is an optimistic rule that does not take into account the potential loss associated with each decision.

The maximin decision rule determines the minimum possible payoff for each decision and selects the alternative with the largest minimum payoff. The minimax

regret decision rule involves the concept of regret or opportunity loss. It converts the payoff matrix into a regret/opportunity loss matrix populated with opportunity loss values. For example, the opportunity loss (or regret) for alternative decision A equals the maximum payoff among all alternatives under a particular state of nature minus the payoff for alternative A. To apply this decision rule, one lists the maximum amount of regret for each alternative decision and chooses the decision with the smallest (or minimum) maximum regret (Hammond, 1999; Brandenburger and Nalebuff, 1995).

A probabilistic method, the Expected Monetary Value (EMV), can also be used using Formula 1 (Hammond, 1999; Brandenburger and Nalebuff, 1995).

The probabilities (the  $p$ 's in Formula 1) are between 0 and 1 for any given event, and the sum of the probabilities across events must sum to 1. Historical data can be gathered to compute the probabilities. An expert may help. If probabilities are unknown, one may use their best judgment, and then discuss the results with others to refine the estimate. Once an EMV has been computed for each alternative, one chooses the alternative with the largest EMV.

#### Formula 1

$$EMV = p_1r_1 + p_2r_2 + \dots + p_jr_j$$

$r_j$  = Payoff for the given alternative  
under the  $j^{th}$  state of nature

$p_j$  = Probability of state of nature  $j$  occurring

A payoff matrix for Excel (based on the interview in Exhibit A) is presented in Table 5.

The maximum payoff is \$2.7 million, so under the maximax decision rule, Excel should decide to expand its elevator. The decision to expand the elevator has a minimum payoff of \$-2.447 million,

**Table 5. Example of Payoff Matrix for Excel<sup>2</sup>**

	VeraSun		No VeraSun	
	SE Others	SE Excel	SE Others	SE Excel
Expand Elevator	192	2,700	-2,477	324
No Expansion	-155	2,079	-1,963	0

<sup>2</sup>The figures in the matrix are in thousands of dollars.

**Table 6. Regret/Opportunity Loss Matrix for Excel**

	VeraSun		No VeraSun	
	SE Others	SE Excel	SE Others	SE Excel
Expand Elevator	0	0	$= -1,963 + 2,447 = 484$	0
No Expansion	$= 192 + 115 = 307$	$= 2,700 - 2,079 = 621$	0	$= 324 - 0 = 324$

while the decision to not expand the elevator has a smaller loss of \$1.963 million, so under the maximin decision rule, Excel should decide not to expand its elevator. The regret/opportunity loss matrix for Excel is presented in Table 6. If the decision is to expand the elevator, the maximum regret is \$484,000; the decision to not expand the elevator results in a maximum regret of \$621,000. So under the minimax regret decision rule, Excel should choose to expand the elevator.

Finally, the expected monetary value associated with the decision to expand the elevator is \$324,080<sup>3</sup>, while the expected monetary value associated with the decision to not expand is \$196,500<sup>4</sup>. Consequently, under the expected monetary value rule, the expansion should occur. Table 7 summarizes the different decision rules and which decision each rule suggests for Excel.

### Decision Trees

An alternative way to visualize the information displayed in a payoff matrix is to transform it into a decision tree. In addition, the decision tree helps clarify the sequence of decisions and events. A decision-tree approach is useful

**Table 7. Summary of the Conclusion under each Decision Rule**

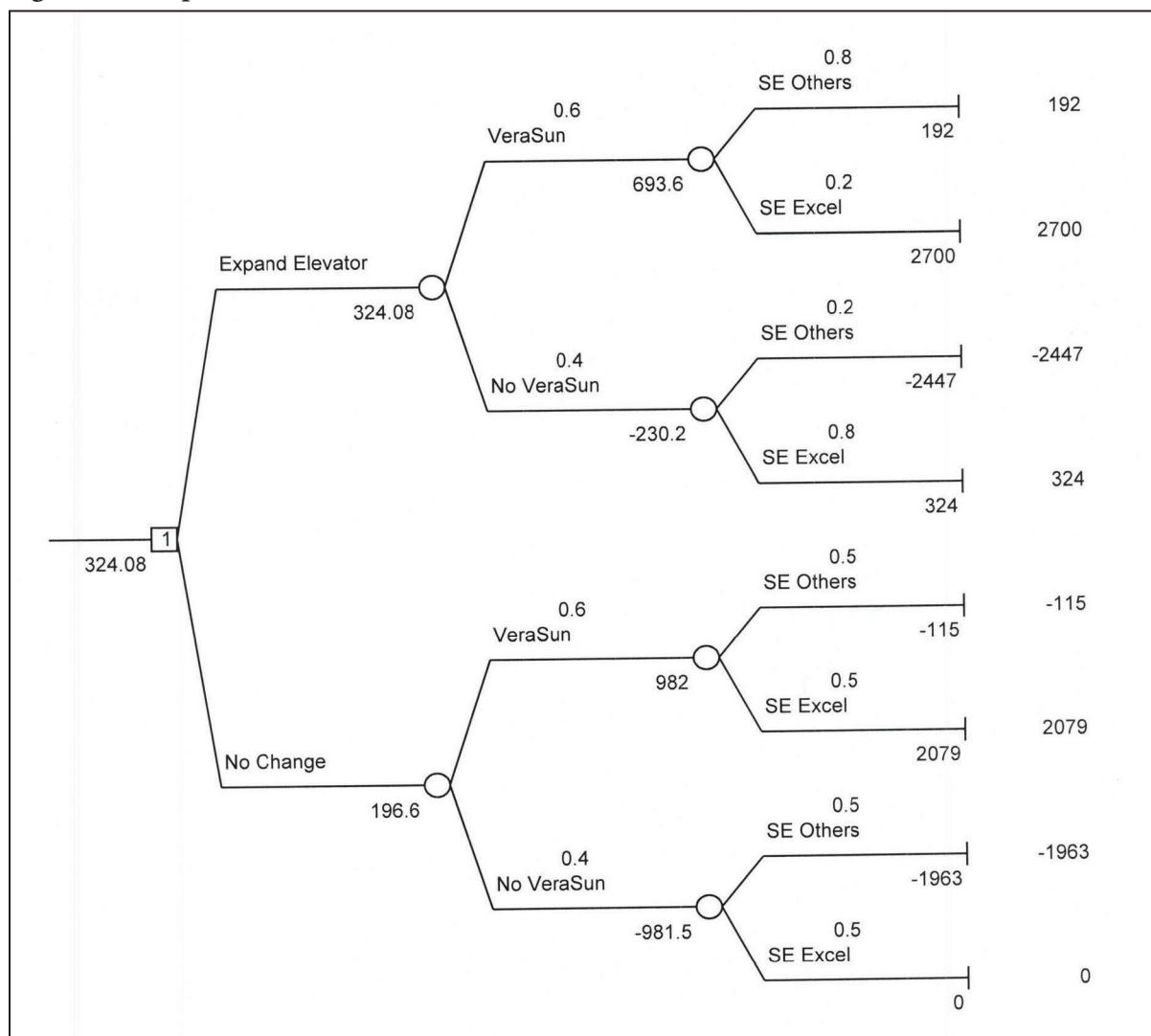
Decision Rule	Conclusion
Maximax	Expand elevator
Maximin	No expansion
Minimax Regret	Expand elevator
Expected Monetary Value	Expand elevator

<sup>3</sup>  $[192*0.8+2700*0.2]*0.6+[-(2447)*0.2+324*0.8]*.4=693.6*0.6+(-230.2)*0.4=324.08$

<sup>4</sup>  $[(-115)*0.5+2079*0.5]*0.6+[-(1963)*0.5+0*0.5]*.4=982*0.6+(-981.52)*0.4=196.6$

for complex decisions/situations. It provides a graphical representation of all the inter-relationships among choices and uncertainties, which are useful to explain the decision processes to others (see Figure 7). Creating a decision tree encourages thorough, logical thinking about a problem and allows for probabilities to be assigned to individual events and the expected outcomes. A decision tree presents two or more decisions, followed by branches representing a set of potential unfolding events that will affect the outcome for the company. The probabilities of each event and the net present value associated with each event can be displayed on the graph (Hammond, 1999; Brandenburger and Nalebuff, 1995; Ragsdale, 1997). The TreePlan Software, an add-in to Microsoft Office Excel, can be used to build decision trees.

**Figure 7. Example of Decision Tree for Excel**



Using the information presented in the earlier discussions on scenario analysis and payoff matrices, the decision tree can be constructed with the first node representing the decision to expand (or not) the elevator, followed by two events. The first event is whether the VeraSun plant is built. This will affect the probabilities of the second event—whether the Southeast feeders continue to source their grain from Excel or go to other suppliers. The final payoff for each branch of the decision tree is indicated at the right end of the branch. For each decision node of the tree, the expected payoff of that decision is determined by the payoff for each branch emanating from that decision node times the probability of the event designated by that branch. The decision that exhibits the largest expected value is typically chosen as the preferred strategy, but the financial consequences of alternative decisions are clearly illustrated by the decision tree

### *Real Options Valuation*

In addition to evaluating the uncertainties associated with decisions, it is particularly important to consider options to manage downside risk. One way to limit downside risk is by using real-options strategies. Real options are a direct extension of financial options, but focus on physical or real assets, instead of financial derivatives. In essence, a real option is like a financial option—investing a modest amount today to acquire a right to buy an asset in the future. When the future arrives, the purchase can be made or the option is allowed to expire, depending on the profitability, or lack thereof, of that asset at that point in time. In short, the option approach enables one to maintain the right or the position to exploit that potential opportunity without having to make a commitment to do so today. This approach is regularly used in making business decisions where option payments are made to maintain the right to acquire a particular parcel of real property in the future, minority investments are made in start-up companies with an agreement to have the first right to buy a majority interest in some future time period, or pilot plants are constructed to test an idea before a full-scale manufacturing facility is built (McGrath and McMillan, 2000; Luehrman, 1998; Detre et al., 2005).

This method of thinking explicitly considers the benefits additional information will have on the value of a decision or investment. A real options framework is appropriate for situations where the manager can make incremental decisions throughout time, thus creating flexibility in the decision. Such options might include deferring, abandoning, or expanding a given project. This flexibility is only valuable if managers are allowed to incorporate new information into their decisions over time. Thus, real options allow management to make informed and accurate decisions over the course of time (McGrath and McMillan, 2000; Luehrman, 1998; Detre et al., 2005).

There are different types of real options (Boehlje et al., 2005):

- Growth: Making investments today to maintain the “option to play” in the future.
- Contract/Divest: Flexibility to reduce the commitment or divest resources in the future at

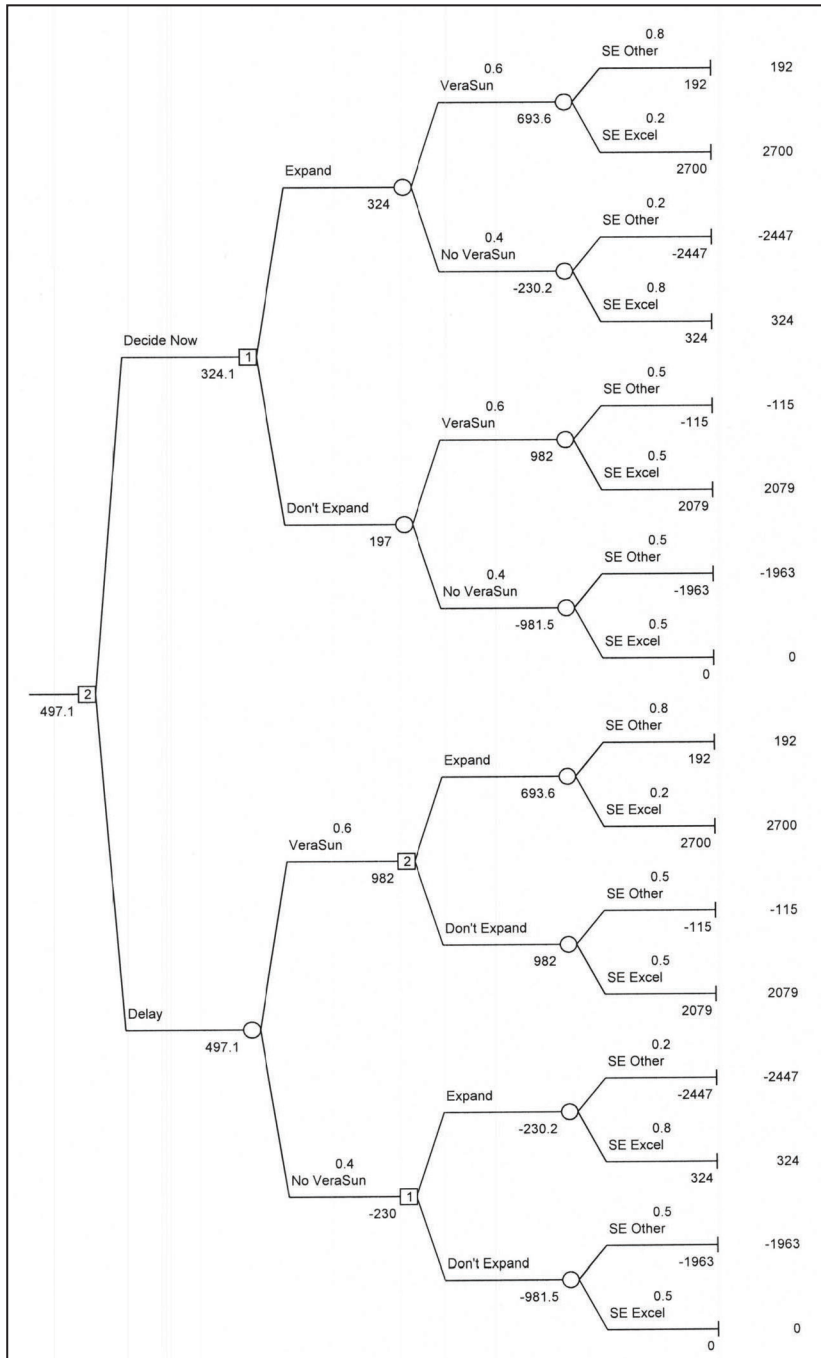


high residual values or minimum costs if events turn negative.

- Sequence/Follow-on: Deliberately sequencing decisions and making incremental investments to maintain flexibility.
- Pause/Wait: Deliberate reasons to delay with a trigger to commitment.
- Shut-down/Switch: Temporarily stop when variable costs cannot be covered.

To illustrate the application of options analysis, the value for Excel to wait until VeraSun makes its decision whether or not to build the plant can be estimated. To do this, TreePlan can be used to create a new branch in the Excel decision tree (see Figure 8). The first node of the decision tree, or initial decision, would be a delay decision, and therefore, the decision becomes—expand now or delay. Compared to the previous decision tree of Figure 7, the decision on whether or not to expand the elevator is made after the VeraSun event has been determined. All other probabilities and the payoffs associated with each original branch remain the same, but adding the delay decision to the analysis will likely change the expected payoff of the various decision nodes compared to the original decision tree.

**Figure 8. Example of Decision Tree for Excel with a Delay Option**



The results of the new decision tree are interpreted as before. Using the numbers in Figure 8, the expected monetary value associated with the strategy to decide now is \$324,100, while the expected monetary value associated with the strategy to delay is \$497,100. Consequently, under the expected monetary value rule, Excel would delay the decision.

An option for Excel to make an incremental investment to increase its elevator capacity can also be examined. Assume Excel has the option to enter a 50/50 joint venture with another elevator to build an elevator with 700,000 bushel of storage. Excel has the right to purchase the other 50 percent of the elevator for \$1.5 million in two years. Meanwhile, Excel can gather additional information and decide whether to exercise the option and make the additional investment. Thus, Excel reserves the opportunity to invest more in the elevator after seeing how the market unfolds in a two-year period, by exercising (or not) the option in two years. This decision tree is presented in Figure 9.

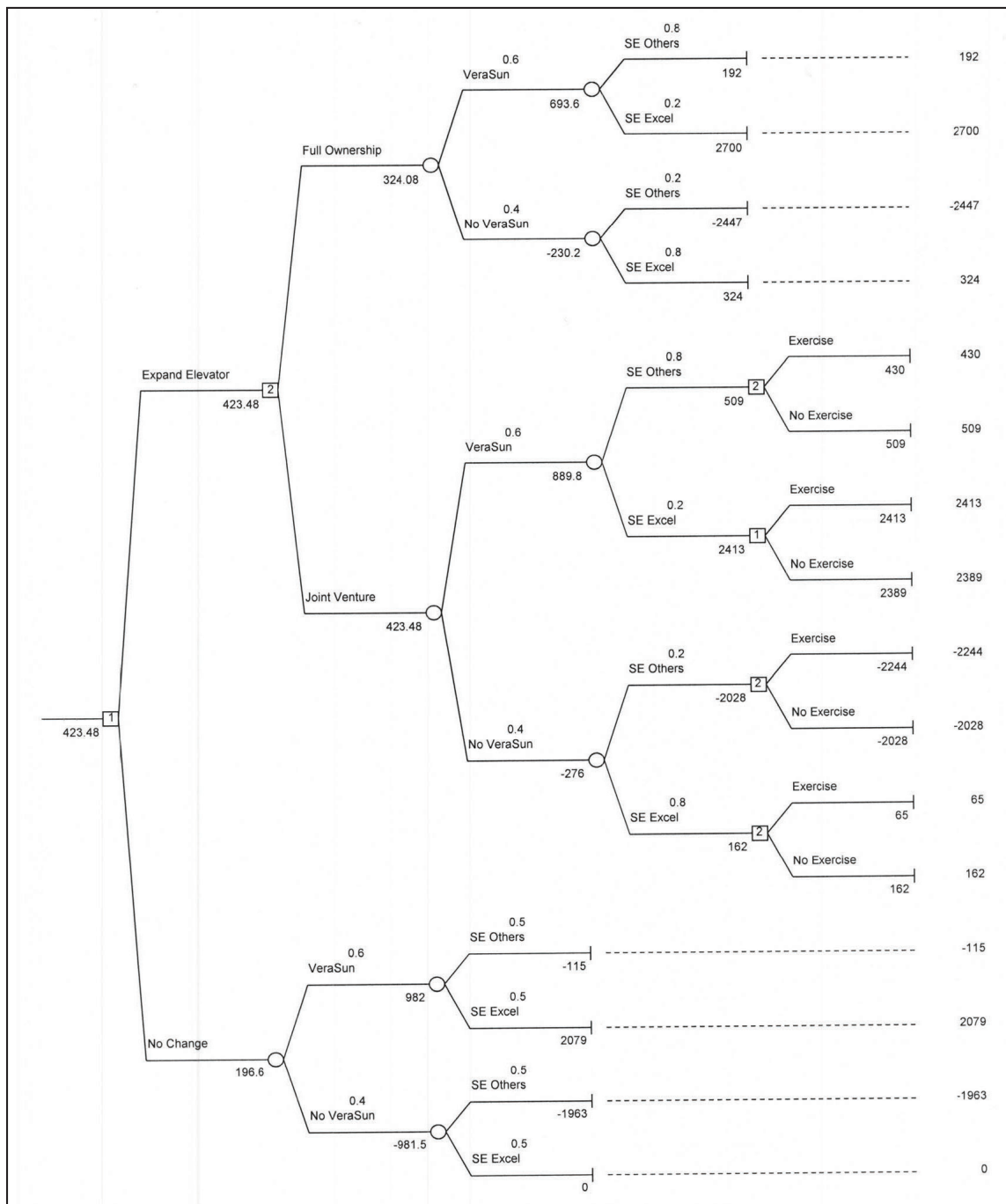
Using the numbers in Figure 9, the expected monetary value associated with the decision to expand the elevator is \$423,480, while the expected monetary value associated with the decision not to expand the elevator is \$196,800. Consequently, under the expected monetary value rule, Excel would expand the elevator. With full ownership, the expected monetary value is \$324,080, while with a joint venture, the expected monetary value is \$423,480. Consequently, under the expected monetary value rule, Excel would expand by entering a joint venture with another elevator.

### *Options Portfolio Mapping*

Real-options concepts are useful in structuring a decision to manage downside risk while maintaining the possibility to capture upside potential. Most companies have the potential to pursue several uncertain projects at the same time. Thus, it is important to consider the portfolio of alternatives and options to ensure there is a healthy balance between innovative ideas and the level of risk. The portfolio of options framework is useful to assess and manage the alternative strategic choices available to a company. Given the technical and market uncertainty that surrounds almost all new projects, a real-options approach combined with portfolio concepts has the potential to maximize the value of new projects or innovations while minimizing the risk (McGrath and McMillan, 2000).

Market uncertainty refers to the lack of knowledge at the market and demand level. Major sources of uncertainty are the potential revenue/demand, the regulatory aspects, the associated cost, and the upstream supply chain reaction to the innovation project. Technical uncertainty comes from the lack of information about the viability of the innovation. The firm does not know whether or not the technology can be developed and which inputs and skills are needed. The firm also does not know if it has the manufacturing skills and capacities to produce the

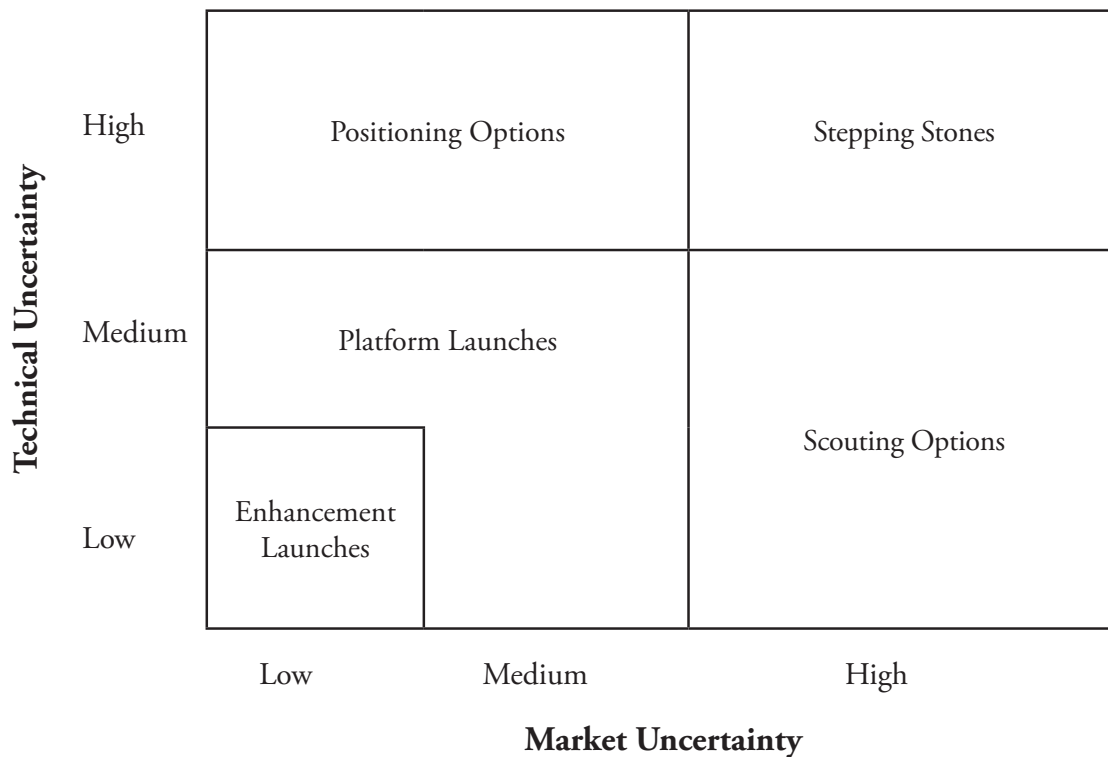
**Figure 9. Example of Decision Tree for Excel with a Growth Option**



product, nor if the user (and even the sales force) will know how to use the product (McGrath and McMillan, 2000; Luehrman, 1998; Detre et al., 2005).

McGrath and MacMillan (2000) suggest that there are four basic categories of new projects when viewed from the perspective of market uncertainty and technical uncertainty (see Figure 10).

**Figure 10. Portfolio Map**



Positioning options create the right to wait and observe what technologies or standards will develop to serve a relatively well-defined and certain market. Scouting options focus on taking relatively well-understood technologies and products to a new and not well-understood potential customer base. Stepping stone options face both high technical and market uncertainty, and so should be initiated with “experiments” to either gain more information as to customer wants and needs, or increased capability and capacity relative to the preferred technology to respond to those needs. Launches (platform and enhancement) involve full-blown commitments that can be safely made because both the technology and the customer base are reasonably well understood and less uncertain.

Now the portfolio arguments can be introduced. To foster the development of new projects, and at the same time, to reduce the risk of new ventures, expansion funding and activities should be allocated in a portfolio context with a specified percentage of the financial and personnel budget (say 10 or 20 percent) used to initiate activities that are positioning options, stepping stones, or scouting options, rather than allocating all resources to platform or enhancement launches. The basic argument is that to sustain growth through innovation and new projects, but at the same time, manage the technical and market risk associated with that growth, a company should develop and manage a portfolio of innovations and new projects using this portfolio of real-options framework. Figure 11 summarizes a portfolio of options for Excel that was gathered from the participants of an executive program in which the case was used. There are several opportunities Excel might investigate

**Figure 11. Excel's Portfolio Map**

Technical Uncertainty	High	<ul style="list-style-type: none"><li>• Joint venture grain storage with competitor</li><li>• DDGS production for SE and for Excel’s swine business</li></ul>	<ul style="list-style-type: none"><li>• DDGS production with VeraSun</li><li>• IP-high extractable starch corn for ethanol</li></ul>	
	Medium	<ul style="list-style-type: none"><li>• Provide a one-stop shop for members: finance, insurance</li><li>• Focus on grain brokering for SE, not just origination</li></ul>	<ul style="list-style-type: none"><li>• Joint venture with VeraSun on investment in additional storage capacity</li><li>• VRT and precision services growth</li></ul>	
	Low	<ul style="list-style-type: none"><li>• Joint venture partner in agronomy (seed, fertilizer)</li><li>• Cross-division, customer-loyalty program</li><li>• Grow swine business</li></ul>		
		Low	Medium	High
Market Uncertainty				

beside expanding the grain elevator. In other words, there are several positioning options, stepping stones, and scouting options that Excel can use to capitalize on the uncertainty with the ethanol demand. For example, Excel could decide to expand the area from which it sources grain—it could establish a joint venture with someone in another region. This would decrease the market risk by increasing the corn acreage base from which to source grain. This option might have high technical uncertainty because the facility is not in proximity; it is in another region.

We can also map the option presented in the decision tree—Excel could joint venture with another supplier (or with VeraSun) to invest in additional storage. This would not decrease the market uncertainty, but it would decrease the share of risk Excel has to absorb and would not create additional technical uncertainty.

Excel could also investigate the opportunities to market the DDGS by-product from the VeraSun plant. This could be particularly useful if the DDGS could be used as a substitute for grain in Excel's swine business and for the Southeast market. While the DDGS production bears some technical uncertainty, market uncertainty could be limited if Excel makes a modest investment in distribution facilities that would only answer the needs of its current customer—thus a positioning option. Excel

could also share the investment and the risk with VeraSun, build a larger DDGS plant, and be in charge of marketing the DDGS—thus a stepping stone.

Another area of opportunity is high extractable starch corn. High extractable starch corn provides more gallons of ethanol per bushel. Excel could be in charge of the storage and the identity preservation (IP) of high extractable starch corn. There is technical and execution uncertainty with this option in that IP activities would be a new skill set for Excel to develop since they currently handle and store bulk commodities. Whether VeraSun would be willing to pay a premium for this specialty corn creates market uncertainty—this would likely be a stepping stone.

In terms of scouting options not directly related to ethanol, Excel can also investigate expanding its offerings of variable rate technology (VRT) and precision services. The technical and execution uncertainty is medium to low because the technology has already been developed, and Excel already sells these services. Whether or not there is adequate demand creates market uncertainty. Opportunities for platform launches are also possible—Excel could provide its members a one-stop shop by offering financing and crop insurance, in addition to grain origination and agronomy services. Whether the member would use those services creates some market uncertainty. Excel could become a grain broker by buying grain from non-cooperative members; this would generate medium technical uncertainty because Excel originates grain, but not as a broker per se, and low to medium market uncertainty in that Excel already has contact with the Southeast market, as well as local buyers. This option would likely be viewed as a platform launch.

Because Excel's performance in the agronomy division has been deteriorating, another avenue Excel could explore would be to partner with another firm to sell seed, fertilizer, and chemicals. Excel could also create a cross-division, customer-loyalty program and/or grow the swine business and feed the hogs DDGS. These projects would have both low technical (the technology exists) and market (Excel already has a customer base) uncertainties—thus enhancement launches.

The key issue for Excel is to identify these and similar options, and manage them in a portfolio context so as to continue to grow the business without taking on undue risk.

### *Psychological or Decision Traps*

Although strategic flexibility can be used to manage uncertainty, eventually a decision must be made. The decision-making process is often accompanied by bias, particularly for managers who may have a vested interest in a particular project. Table 8 summarizes the bias or psychological traps in any decision and provides suggestions to limit the decision bias (Hammond, 1999).

**Table 8. Psychological and Decision Traps**

Name	Definition	Solution
Sunk Cost Trap	<ul style="list-style-type: none"> <li>• Throwing good money after a bad investment</li> <li>• Refusing to acknowledge a mistake</li> </ul>	<ul style="list-style-type: none"> <li>• Deal with the reason the mistake is trouble for you</li> <li>• Make the consequences of dealing with the issue part of the decision process</li> <li>• How would I handle this if I were brought in to clean things up?</li> </ul>
Over-Confidence Trap	<ul style="list-style-type: none"> <li>• We aren't nearly as good as we think we are when it comes to estimates</li> <li>• Many times due to anchoring</li> </ul>	<ul style="list-style-type: none"> <li>• Ask "questions" about the extremes, the 'remote' possibilities</li> <li>• Homework! Use facts instead of opinions...</li> </ul>
Prudence Trap	<ul style="list-style-type: none"> <li>• Slanting odds, estimates to be safe</li> <li>• A major problem in sales forecasting with limited supply</li> </ul>	<ul style="list-style-type: none"> <li>• Seek/demand honest input</li> <li>• Document information/reasoning</li> <li>• Sensitivity analysis</li> <li>• Use a process to document problem areas, focus on fixing those</li> </ul>
Recallability Trap	<ul style="list-style-type: none"> <li>• We remember the disasters, the unconditional victories</li> </ul>	<ul style="list-style-type: none"> <li>• Use data, or build up your estimates in pieces if data unavailable</li> </ul>
Confirming Evidence Trap	<ul style="list-style-type: none"> <li>• "Biased research"</li> <li>• Make the decision before gathering the facts, then seek (subconsciously) evidence to support your "decision"</li> </ul>	<ul style="list-style-type: none"> <li>• Use a "devil's advocate" in any major decision exercise</li> <li>• "Pressure test" with those outside the decision</li> <li>• Expose yourself to conflicting information</li> <li>• Be careful not to ask leading questions in seeking advice</li> </ul>
Framing Trap	<ul style="list-style-type: none"> <li>• Framing as gains vs. losses—biases toward the gains</li> </ul>	<ul style="list-style-type: none"> <li>• Framing with different reference points</li> <li>• Can bias the decision up or down, magnifying or minimizing the consequences</li> <li>• Don't just accept the initial frame, look for distortions caused by the frame</li> <li>• "Let's look at this problem in a different way"</li> </ul>
Anchoring Trap	<ul style="list-style-type: none"> <li>• First idea, piece of data, history anchors decision</li> </ul>	<ul style="list-style-type: none"> <li>• Widen your perspective with outside opinions</li> <li>• Think about on your own before getting outside perspectives</li> <li>• Don't share your ideas until you get outside perspectives</li> </ul>
Base-Rate Trap	<ul style="list-style-type: none"> <li>• Neglect relevant information</li> <li>• Focus on the wrong data in a decision setting</li> </ul>	<ul style="list-style-type: none"> <li>• Use data, don't mix probabilities</li> </ul>
Outguessing Randomness Trap	<ul style="list-style-type: none"> <li>• Assigning trends when none are present</li> <li>• Stuff happens</li> </ul>	<ul style="list-style-type: none"> <li>• Don't try to outguess random phenomena, it can't be done</li> <li>• Revisit theory, seek good explanations</li> </ul>
Status-Quo Trap	<ul style="list-style-type: none"> <li>• Change requires effort, "the devil that you know and the one that you don't"</li> </ul>	<ul style="list-style-type: none"> <li>• Status quo is virtually never the only option</li> <li>• Would you choose the status quo, if it weren't the status quo?</li> <li>• Avoid exaggerating the switching cost</li> <li>• Don't compare "is" vs. "would be"</li> </ul>



It is often not easy to accept that maybe it is time to kill a project, particularly one in which substantial time and money have been invested. One may think about the sunk costs/non-retrievable costs (the sunk cost trap) associated with a project, or refuse to acknowledge a mistake. Some tend to be over-confident about their estimates (the over-confidence trap); and/or be too pessimistic in the choice of probabilities (the prudence trap); and/or exaggerate the probability of rare, but catastrophic occurrences (the recallability trap) because decision-makers tend to be overly influenced by past dramatic events. Some may also be tempted to seek (subconsciously) evidence to support a decision (the confirming-evidence trap). The way a problem is specified can profoundly influence the choices one makes (the framing trap)—if a problem is posed in terms of gains, people tend to be risk averse. Alternatively, they are risk seeking if a problem is posed in terms of avoiding losses. In addition, the problem may subconsciously be framed such that a proposed solution seems to be the best answer. Some decision-makers may give more weight to the first idea or piece of information (the anchoring trap); give weight to the wrong piece of data while neglecting the relevant ones (the base-rate trap); or assign trends when none are present (the outguessing randomness trap). Sometimes, no change seems like the only solution (the status quo trap)—that is rarely the case, and the switching costs are often exaggerated.

Using systematic analytical procedures, including the ones previously discussed, is the most effective way to reduce the impact of the biases or traps in making decisions in an uncertain environment.

## **A Final Comment**

The methodology and analytical tools presented here do not guarantee improved decisions in an environment of uncertainty—they just improve the chances of a better decision and outcome. Using the framework and tools to frame the choices should not only sharpen the focus on the most important decision factors or components, but also assist in a targeted search for the most useful and relevant data and information to inform and improve the decision. But, by definition in an uncertain world, good decisions (i.e., well informed and reasoned) do not guarantee good outcomes—strategic flexibility and options thinking are critical to capture the potential and reduce the exposure of decisions that must be made in an uncertain environment.



## Bibliography

Boehlje, M., A. W. Gray, and J. D. Detre (2005). "Strategy Development in a Turbulent Business Climate: Concepts and Methods." *International Food and Agribusiness Management Review*, 8 (2): 21-40.

Brandenburger, Adam M., and B. J. Nalebuff (1995). "The Right Game: Use Game Theory to Shape Strategy". *HBR*, July-August 1995

Bristow, John B. (1990). "Note on Scenario Planning: An Abridged Version". *Graduate School of Business Administration, University of Virginia*.

Detre, J., B. Briggeman, M. Boehlje, A. Gray (2006). "Scorecarding and Heat Mapping: Tools and Concepts for Assessing Strategic Uncertainty". *International Food and Agribusiness Management Review*, 9 (1): 1-22.

Hammond, John S.; R. L. Keeney, and H. Raiffa (1999). "Smart Choices, A Practical Guide to Making Better Decisions". *Harvard Business School Press*, Boston, Massachusetts.

Luehrman, T. A. (1998) "Investment Opportunities as Real Options: Getting Started on the Numbers." *Harvard Business Review*: 51-67.

McGrath, R. G., and I.C. MacMillan (2000). "The Entrepreneurial Mindset." Boston, MA: Harvard Business School Press.

Ragsdale, Cliff T. (1997) "Spreadsheet Modeling and Decision Analysis, a Practical Introduction to Management Science". South-Western College Publishing, 2nd edition, Chapter 16.

Raynor, Michael E. (2007) "The Strategy Paradox: Why Committing to Success Leads to Failure [and What to Do About it]." Currency Doubleday Publishing. Chapter Nine.

Schnaars, S. and P. Ziamou (2001) "The Essentials of Scenario Writing". *Business Horizons*, July-August 2001.

Schoemaker, Paul J.H. (1995) "Scenario Planning: A Tool for Strategic Thinking" *Sloan Management Review*; Winter 1995, p25.

Wilkinson, Lawrence. "How to Build Scenarios". <http://www.wired.com/wired/scenarios/build.html> accessed on 03/02/2009.

## **Exhibit A. An Interview with George Green, CEO of Excel Cooperative**

WSJ: George, the dynamics of the grain industry in your region have really changed in a short period of time. How is this affecting Excel Cooperative?

GG: The increase in ethanol demand, nationally, is changing the shape of the corn and soybean market without question. In our local area there are four ethanol plants being built around us. Plus, VeraSun Corporation is considering building a 100-million gallon ethanol plant right in our backyard. This change has implications for all of our divisions, including the agronomy and feed divisions. But, probably the most important implications are in our grain division. We are trying to decide if we need to invest in additional storage and handling capacity to take advantage of the situation or just stay where we are and let things play out.

WSJ: What does your current plan look like for expanding the grain storage?

GG: We have begun the process of looking into building 700,000 bushels of additional grain storage at our South Reynolds plant. With attendant infrastructure improvements, we believe that this will require about \$2.2 million in investment on our part. If the VeraSun plant comes in, we would be well positioned to supply a good portion of that plant's corn needs with this additional infrastructure. Part of our concern is that we are not sure how the feeders in the Southeast, which we serve with much of grain now, will react to the increased demand for corn locally. And, if we commit to this investment now and VeraSun decides not to go through with its plans, we could be struggling to get our investment back.

WSJ: Assuming VeraSun enters the market, what impact will that have on the profitability of your expansion?

GG: My team has been running some numbers on this. As long as corn production increases as expected in the area and SE feeders can find corn from other markets without becoming too aggressive in using our other competitors to acquire grain, we could see returns in the neighborhood of \$2.7 million. If the SE feeders get aggressive with our competitors, and we have to compete aggressively to get the grain then we would probably see a reduction in our elevator turnover and might see only \$192,000 in returns.

WSJ: So either way it is not a bad deal it seems.

GG: Well, if the SE feeders are aggressive it isn't great but we could live with it since the VeraSun entry will probably raise margins a little. What is more concerning is if VeraSun doesn't enter but the SE feeders are aggressive with our competitors anyway. If that happens, we have a problem on our hands because we could end up with lower turnover and lower margins resulting in a loss of \$2.4

million. Of course, if we can keep the SE feeders looking to us for their grain and working with us to be aggressive in the marketplace while still maintaining our normal margins, we could still come out ahead at about \$324,000.

WSJ: What do you think the probabilities are that VeraSun enters and how your SE feeders might react?

GG: Right now, we think that there is about a 60 percent chance that VeraSun will enter the market. The reactions of the SE feeders are a little trickier. If VeraSun enters the market, we expect the SE feeders to be more aggressive. If we expand and VeraSun enters the market then we think there is an 80 percent chance the SE feeders will seek out our competitors in local markets to acquire grain. But, if VeraSun doesn't enter the market and we have our expansion in place, we believe this will signal to the SE feeders that we can meet their needs and there is an 80 percent chance they will come to us. If we don't expand, then it seems there is 50/50 chance that the SE feeders will go either way.

WSJ: Speaking of not expanding, what do the economics look like for you if you don't expand?

GG: Well, if VeraSun enters and we haven't expanded but we can deliver to them and our SE feed markets will let us be aggressive, then we will be in pretty good shape with about \$2.0 million return. But if our SE feeders seek other elevators for procurement, we could be in some trouble with about a \$115,000 loss. If VeraSun doesn't enter but we can keep our SE feed markets, we will breakeven. Where it gets scary is if VeraSun doesn't enter and our SE feed markets look elsewhere for their grain. Then, we are looking at about \$2.4 million loss.

WSJ: George, you have some pretty hefty decisions to make here. Certainly, there is plenty of opportunity here, but there is also a lot of downside. Thanks for giving us an overview of your thought process and good luck to you.

GG: Thank you.