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International Food and Agribusiness Management Review
Volume 9, Issue 1, 2006

Scorecarding and Heat Mapping: Tools and Concepts for Assessing Strategic Uncertainty

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Abstract

The dramatic changes occurring throughout the agriculture industry are creating new and different uncertainties that result from a turbulent business climate. The objective of this paper is to present a methodology to understand, assess and evaluate, and manage strategic uncertainty. The approach is to present a mental model that frames assessment of strategic uncertainty from a potential and exposure perspective. Scorecarding and heat mapping assessment tools operationalize the mental model. Participants in an executive agribusiness educational workshop applied this mental model and the assessment tools to one of three hypothetical seed companies. The participants then provided an evaluation of the usefulness and effectiveness of uncertainty scorecarding and heat mapping.

Keywords: Uncertainty, scorecarding, strategic uncertainty, heat mapping, potential, exposure, likelihood

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Introduction

The dramatic changes occurring throughout the agriculture industry, including disease and food safety crises such as bird flu and BSE, and changes in government policy including energy policy particularly renewable energy incentives and increased (or decreased) farm subsidies; are creating new and different uncertainties than the traditional operational and financial uncertainties agribusinesses have faced in the past. These new uncertainties result from strategic choices and a turbulent business climate. From both an analytical and managerial perspective, a major challenge in the future will be to assess both the frequency of occurrence and the magnitude of these uncertainties (Economist 2004 and Nottingham 1996). The objective of this paper is to present a methodology that helps teach agribusiness managers how to understand, assess, evaluate, and manage these new and different strategic uncertainties.

The approach is to present a mental model that frames assessment of strategic uncertainty from both a potential and an exposure perspective. Scorecarding, a process for taking qualitative discussions about strategic uncertainty and turning these discussions into quantitative rankings, and heat mapping, a process of taking the rankings from scorecarding utilizing both colors/symbols and generic strategies to communicate the impact of the uncertainty on the business, are assessment tools which operationalize the mental model. In essence, the mental model in this paper is 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. Participants in an executive agribusiness educational workshop applied this mental model and the assessment tools to one of three hypothetical seed companies. The participants then provided an evaluation of the usefulness and effectiveness of uncertainty scorecarding.

Strategic Uncertainty

The first step in assessing strategic uncertainty requires an understanding of the sources of strategic uncertainty. Boehlje et al. (2005) note that “strategic uncertainty is the sensitivity of the company’s value to inappropriate strategic choices, ineffective strategy implementation, or uncertainties in the business climate². These uncertainties include: 1) political, government policy, macro-economic, social and natural contingencies, and 2) industry dynamics involving input markets, product markets, competitive and technological uncertainties.”

² Knight (1921) would argue that risk and uncertainty are separate entities. With risk, the firm would have a priori knowledge of the underlying probability distribution but with uncertainty, there is not a priori information about the probability distribution. Hillson (2003), whose views reflect our own, notes that risk is any uncertain event or set of circumstances that, should it occur, would have an effect on one or more objectives. Thus, firms must utilize all available information to form best-guess estimates about the impacts of these risks through quantitative and qualitative methods to determine the realm of possible outcomes and choose strategies based on these outcomes.

Therefore, firms must evaluate and manage strategic uncertainty through proactive strategies that capture the potential benefits of the uncertainty and mitigate the exposures if they fail to act. Teach (1997) developed a taxonomy of total risks faced by a firm. Within this taxonomy, he provides a detailed discussion of the different strategic risks faced by a firm. Table 1 summarizes our adaptation of Teach's taxonomy. The synopsis provided in Table 1 illustrates that strategic uncertainties are more complex and more pervasive than is often perceived.

Firms must be proactive in managing uncertainty to create long-term value because uncertainty has upside potential as well as a downside exposure (Pascale et al. 2000). The dimension of potential refers to the incremental value the uncertainty category offers to the firm, while exposure refers to the downside loss that an

Table 1: Dimensions of Uncertainty in Agribusiness*

Categories of Strategic Uncertainty		Sources of Strategic Uncertainty
Business /Operational	Operations and Business Practices	Contractual uncertainty, internal processes and controls, management transitions
	People and Human Resources	Recruiting, training, retention, organizational culture
	Strategic Positioning and Flexibility	Mergers and acquisitions, joint ventures, resource allocation and planning, organizational agility, information access
Financial	Financing and Financial Structure	Debt structure, non-equity financing
	Financial Markets	Portfolio misalignment
Market Conditions	Market Prices and Terms of Trade	Contract terms, market outlets, market access
	Competitors and Competition	Antitrust, industrial espionage
	Customer Relationships	Poor market timing, inadequate customer support
	Reputation and Image	Corporate image, brand image, reputation of key employees, community relationships
Technology	Technological	Complexity, obsolescence, workforce skill-sets, adoption rate, diffusion rate
Business Relationships	Business Partners and Partnerships	Interdependency, confidentiality, cultural conflict, information sharing
	Distribution Systems and Channels	Access, dependence on distributors
Policy & Regulation	Political	Enforcement of intellectual property rights, change in leadership, revised economic policies, budget shortfalls
	Regulatory and Legislative	Government trade negotiations, government farm subsidies

* Adapted From Teach (1997)

uncertainty poses for the firm. It is important for firms to account for the potential or opportunity of the uncertainty as well as the downside or exposure (risk) if proper strategic management decisions are to be made (Nottingham 1996). The focus on the upside potential of uncertainty is one of the key factors that differentiates this set of assessment tools from other tools that emphasize only risk exposure³. Focusing only on uncertainty avoidance could cause a firm to overlook opportunities to create value; uncertainty management should involve assessing both potential and exposure (Talavera 2004).

Assessing Uncertainty

Assessing uncertainty through qualitative rankings is not a new concept and methods for doing so have been suggested by others (see Groth 1992 for a summary). To understand fully how to manage uncertainty, firms should first assess the four critical dimensions of each source or category of uncertainty: potential, exposure, the likelihood of potential, and the likelihood exposure. These dimensions characterize the uncertainty in terms of the impact each category can have on the firm's profitability, image, and competitive position in the marketplace. Table 2 provides an illustrative listing of various potentials and exposures associated with each category of uncertainty. Systematic assessment of these dimensions of uncertainty is the key to understanding uncertainty management. Considering the size of the potential or the exposure of the uncertainty without accounting for the likelihood, can cause management to make incorrect assumptions about the uncertainty and its ability to impact company profit (Baldoni 2001).

Potential is often overlooked in managing uncertainty and may result in conservative decisions that ignore the opportunity to create long-term value. Potential can be thought of as the opportunity to create additional profits if the firm exploits an uncertainty (Hillson 2003). When outcomes are favorable, the firm may find itself with such benefits as a new market, more loyal customers, or a distinct cost advantage over rivals. Initiating the uncertainty assessment process by measuring potential can frame the firm's goals in the context of how it can manage the uncertainty to create increased profits or improved financial performance. For example, a business relationship uncertainty in terms of supply chain arrangements might create potential in the form of loyal retailers who promote our agribusiness products over our competitors.

The second dimension, exposure, asks, "if this category of uncertainty has a negative outcome, how bad will it be?" Exposure is often defined in terms of how many dollars the negative outcome will cost the company because of lost customers, a tarnished image, legal fines, etc. By assessing the exposure, management is aware

³See Boehlje, Gray, and Detre 2005 for an example of tools focused on managing downside risk.

of the dangers of the uncertainty and can make informed decisions based on the possible exposure. An exposure that may arise in supply chain arrangements would be if retail sellers reneged on the terms of a contract.

Likelihood is the chance a potential or exposure event will occur. Having determined the potential (exposure) of a particular uncertainty category, it is critical to assess the chances or likelihood that this potential (exposure) could be realized. In essence, what are the odds that the potential can be captured, and what are the odds that exposure will occur? For each uncertainty category the likelihood of the potential and the exposure need not be the same or symmetric. For example, the assessment might determine that there is a “medium” likelihood that the potential consequence occurs and “high” likelihood that the exposure consequence occurs.

Table 2: Examples of Potentials and Exposures for the Strategic Uncertainties

Categories of Strategic Uncertainty	Examples of	
	Potentials	Exposures
Business /Operational	Superior cost control/operational efficiency, Superior workforce, Creating synergies through scope	Business interruption, Loss of key employees
Financial	Strong financial position, Access to equity funds/investors, Attractive financing terms (amounts and terms), Financial reserves (pursue unanticipated opportunities, weather financial shocks, etc.)	Rising interest rates, Loss of lender, Highly leveraged
Market Conditions	Strong brand, Strong complementary products and bundling potential, First mover advantages, Create high switching costs (create loyalty)	Pricing pressure/discounting by competitors, Loss of market share, Consolidation of customer industry, Hyper-competition
Technology	Speed of innovation and commercialization, Niches not attractive to others, Enhanced learning capacity	Limited acceptance of biotechnology, Slow to commercialize new products, Competitor has preferred standards/platform
Business Relationships	Strong market position of distributors, Strong relationship with processors, Enhanced learning, Access to future opportunities	Dependence on distributors, Not a preferred supplier to processor, Not a key account to suppliers
Policy & Regulation	Increasing market from more open trade, Patent protection, Speed of approval	Changes in intellectual property law, Changes in farm income support, Local limits on technology adoption

A Scorecard for Assessing Uncertainty

Anthens (2004) indicates that the impact and effectiveness an Information Technology (IT) risk scorecard had on managing IT risks at Delta Airlines came from its ability to enable managers to focus their attention on the risk in an easy-to-understand framework. The strategic uncertainty scorecard proposed here transforms qualitative discussions into quantitative rankings that facilitate prioritization and focus managerial energy. In addition, it ensures that agribusiness managers recognize the potential or opportunity of the strategic uncertainty as well as the downside or exposure.

The scorecarding process facilitates discussion/dialogue among key members of the management team as to the strategic opportunities and challenges they face. Each category of strategic uncertainty may have varying degrees of impact on the business units in a firm. In essence, an uncertainty may present an opportunity for one business unit and create a threat for another business unit. The development of a consensus scorecard is necessary to assess accurately the opportunities and threats of each uncertainty as they relate to the entire firm. This tool provides a mental model to focus the assessment process and consequently should be a recurring complement of any strategy planning activity. It is anticipated that the scorecarding activity is initiated at the business unit level but for multiple unit firms, the business unit scorecarding can be critical input into the assessment of growth or downsizing decisions and the overall strategic direction of the company.

Table 3 provides a scorecard for assessing each category of uncertainty. The scorecard presented in Table 3 contains the six broad categories of uncertainty identified in Table 2, which are then rated or assessed on a scale of 1 to 5. A 1 indicates that this uncertainty category is low, unimportant, or has minimal impact and a 5 implies it is high, very important, or has a large impact. To illustrate the scorecarding concept, suppose that the business relationship uncertainty potential is rated 2 with a likelihood of 2, and the exposure a 4 with a likelihood of 3 by a member of the management team. Where do these ratings come from? In essence, these are a manager's informed assessments about the uncertainty.

Each member of a firm's management team should complete a scorecard; multiple views of uncertainty often arise because of an individual's responsibilities within the firm. An individual's rating is useful, but more valuable is the management team's discussion of why individuals rated an uncertainty at a particular level. For example, the manager of the finance department may feel that the business relationship uncertainty has the ability to create substantial opportunity for the company because the company has long-term contracts in place with input suppliers, while the production manager sees this as a threat because they have no other qualified suppliers. The ensuing discussion between these two managers as well as all other members of the management team would focus on why these

Table 3: Strategic Uncertainty Scorecards

Strategic Uncertainty Assessment Scorecard for Potential										
Categories of Strategic Uncertainty	Potential					Likelihood				
	<i>Low</i>		<i>High</i>			<i>Low</i>		<i>High</i>		
Business/Operational	1	2	3	4	5	1	2	3	4	5
Financial	1	2	3	4	5	1	2	3	4	5
Market Conditions	1	2	3	4	5	1	2	3	4	5
Technology	1	2	3	4	5	1	2	3	4	5
Business Relationships	1	2	3	4	5	1	2	3	4	5
Policy & Regulation	1	2	3	4	5	1	2	3	4	5

Strategic Uncertainty Assessment Scorecard for Exposure										
Categories of Strategic Uncertainty	Exposure					Likelihood				
	<i>Low</i>		<i>High</i>			<i>Low</i>		<i>High</i>		
Business/Operational	1	2	3	4	5	1	2	3	4	5
Financial	1	2	3	4	5	1	2	3	4	5
Market Conditions	1	2	3	4	5	1	2	3	4	5
Technology	1	2	3	4	5	1	2	3	4	5
Business Relationships	1	2	3	4	5	1	2	3	4	5
Policy & Regulation	1	2	3	4	5	1	2	3	4	5

perspectives are different and what is the true nature of the uncertainty. This discussion provides insight into the opportunities and challenges these uncertainties provide and allows individuals to reassess their perspectives in response to the discussion. The objective is to create a consensus among the management team that results in a company-wide perspective of the strategic uncertainties facing the firm.

Interpreting the Uncertainty Scorecard

Having assessed the potential, exposure, and the likelihoods of the categories of uncertainty, the next step is to choose a strategy for managing that uncertainty that mitigates the downside exposure and exploits the upside potential. Traditional uncertainty management strategies focus on risk mitigation to prevent an uncertainty from occurring, and if it does occur, minimize the exposure (Wilkerson 2003). In contrast, we assess the scores from the company-wide uncertainty scorecard via a heat map to choose strategies which exploit potential as well as mitigate exposure. Buehler and Pritsch (2004) used a heat map to communicate effectively the dollar value exposure for a given risk by business unit. They indicate that the heat map is an effective method for assessing and communicating uncertainty because it utilizes both numbers and colors (reds and greens) to describe the severity of the risk. Their heat map, however, only considered dollar exposure and did not encompass potential or likelihood of potential.

The proposed strategy matrix or heat map used here is a visual aid that highlights the potential, exposure, and likelihood dimensions of the strategic uncertainties. The heat map utilizes the colors of the stop light: green, yellow, and red as indicators of the impact the uncertainty would have upon the firm's value. The color green indicates to the firm that this uncertainty has a positive impact on firm value. The color red indicates that the uncertainty negatively influences firm value, while the color yellow informs the firm that the effect on a firm's value might be positive or negative. Furthermore, this visual aid motivates a rich and in-depth discussion because the participants are forced to focus their efforts on the most pressing strategic uncertainty. In addition, the generic strategies on the heat map serve as a filter for choosing a specific set of actions or activities for managing a strategic uncertainty.

Using the numbers from the consensus scorecard, the management team can plot each uncertainty's likelihood/potential and likelihood/exposure score on the graphs of Figures 1 and 2, respectively. The likelihood score is plotted on the vertical axis while the potential/exposure score is plotted on the horizontal axis. Each axis is measured from a score of low to high, where a low score corresponds to a number from the scorecard which is less than or equal to three and a high score is a number that is greater than three. For example, if an agribusiness company's scorecard has the potential of the technology category scored a 5 with a likelihood score of 4, they have assigned technology a high potential score and a high likelihood score -- thus mapping technology uncertainty in the upper-right quadrant of the likelihood/potential graph. This procedure is completed for each of the six categories of uncertainty for both potential and exposure.

These graphs provide a visualization of the uncertainty scorecard; the quadrants are color-coded and hand-gestures are utilized to show how a firm has assessed the uncertainty. To illustrate, we will analyze Figure 1, the likelihood/potential graph, beginning in the upper-right quadrant and moving clockwise through the quadrants. The upper-right quadrant is shaded dark green and contains a thumbs-up gesture, indicating that an uncertainty in this quadrant is beneficial to the company because of the high potential and the high likelihood. The next quadrant, high potential and low likelihood, is shaded light green and is represented by a hand-gesture signifying okay. In this quadrant, the uncertainty is unlikely to occur, but if it does, the payoff to the company is significant. The next quadrant is colored red with a thumbs down hand-gesture; here, the uncertainty has low scores for likelihood and potential, indicating that there is no benefit from the uncertainty. The upper-left quadrant contains a yield hand-gesture and is colored yellow. Even though the uncertainty occurs often, the payoff to the company is small.

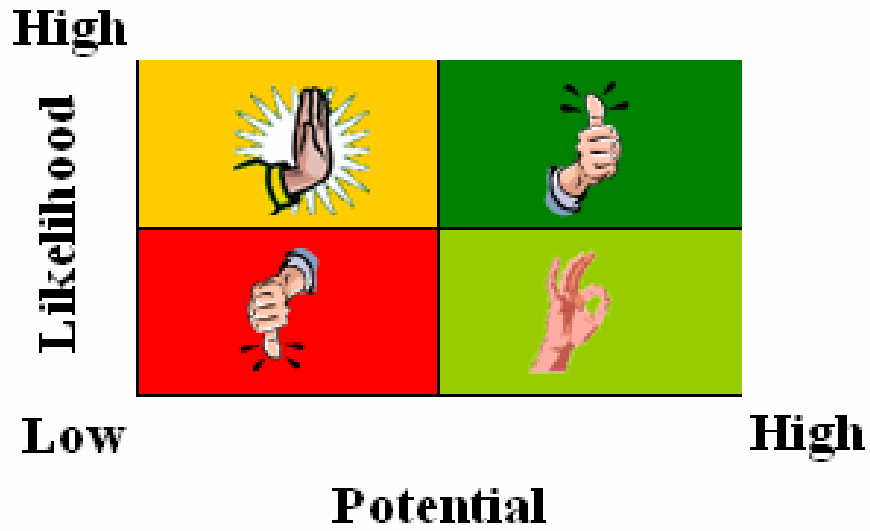


Figure 1: Likelihood/Potential Graph



Figure 2: Likelihood/Exposure Graph

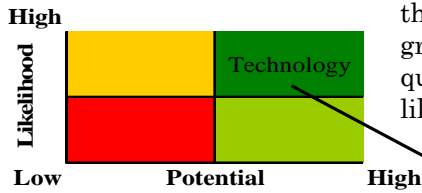
The quadrants for the graph in Figure 2, the likelihood/exposure graph, will also be examined in a clockwise manner beginning in the upper-right quadrant. The upper-right quadrant is colored red because an uncertainty in this category has a high likelihood of occurring and when it occurs the impact on the company is detrimental; the thumbs down hand-gesture indicates that the company needs to avoid this uncertainty. The lower-right quadrant has a yield hand-gesture and is colored yellow because an uncertainty in this category has a damaging impact on the company even though the likelihood of occurrence is low. The next quadrant is colored dark green and contains a thumbs up sign because uncertainties in this quadrant are unlikely to occur and even if they do, there is little impact on the company; these are uncertainties the firm should absorb. The final quadrant, the upper-left, contains the okay hand-gesture and is colored light green; here the uncertainty has little impact on the company even though it has a high likelihood of occurrence.

Notice that the color-coding of the quadrants in Figure 1 and 2 is opposite. This should make intuitive sense; when assessing potential (Figure 1), a high likelihood and high potential (upper-right quadrant) is preferred. When assessing exposure (Figure 2), a low likelihood and low exposure (lower-left quadrant) for the uncertainty is preferred. Thus, both of these quadrants are colored dark green.

To illustrate the heat mapping process, suppose an agricultural seed company's management team has completed a consensus scorecard. Assume the company has state-of-the-art research laboratories, which allows them to capture first-mover advantages and attract lifetime customers. Thus, they have assigned technology a potential score of 4.3 (high) and a likelihood score of 3.9 (high), which maps the uncertainty in the upper-right quadrant of Figure 1. The management team has also assigned an exposure score of 4.6 (high) and a likelihood score of 3.1 (high) which maps the uncertainty in the upper-right quadrant of Figure 2. The exposure scores were awarded because the firm is concerned about having tunnel vision concerning their technology as well as concern about obsolete technology platforms.

The next step in the heat mapping process is integrating the graphs from Figures 1 and 2 into a single heat map. By integrating potential and exposure, we are ensuring that the company considers both the upside and downside of the uncertainty when making strategic decisions. The bottom graph in Figure 3 is a visual representation of the integration of the graphs. The likelihood/potential graph in Figure 1 serves as the base, and embedded in each of its four quadrants is the likelihood/exposure graph. Thus, each quadrant of the likelihood/potential graph is now divided into four quadrants, giving us 16 quadrants for classifying uncertainty. The reason for using the likelihood/potential assessment as the base is that many businesses often fail to recognize the potential an uncertainty offers and concentrate on the exposure of that uncertainty. Plotting the potential first reduces the prospect that management overlooks opportunities.

1. Map likelihood/potential score.



2. Superimpose the map for the likelihood/exposure graph into the correct quadrant of the likelihood/potential graph.

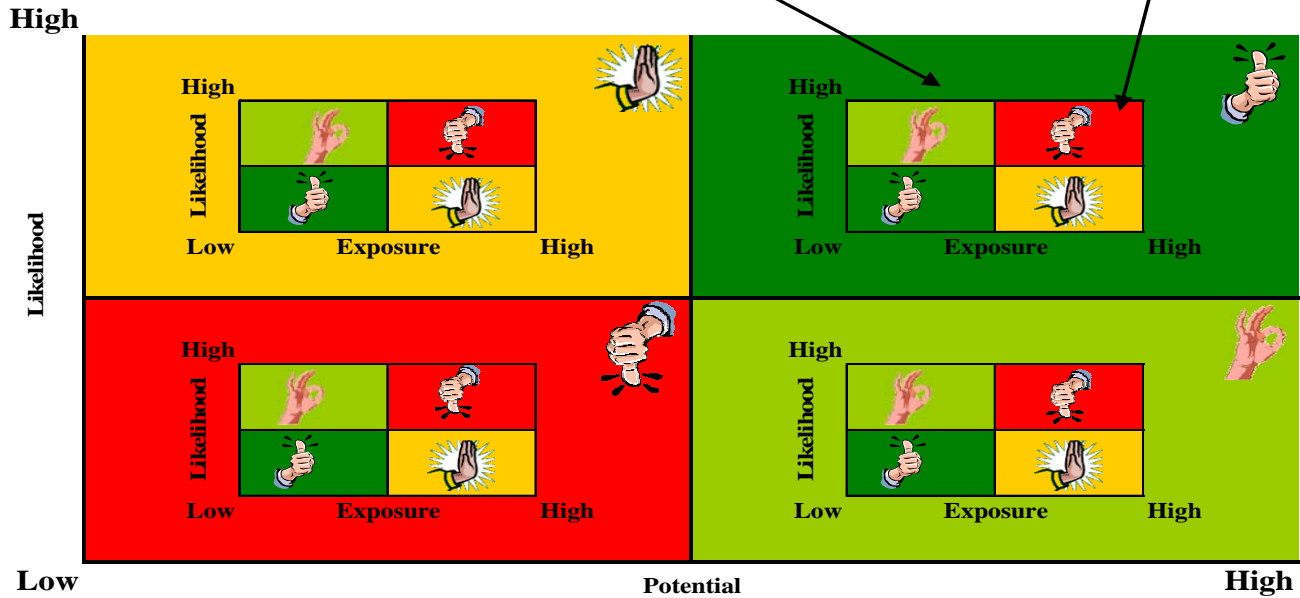
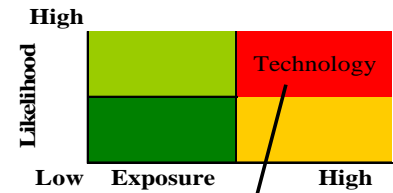


Figure 3: Integrated Likelihood/Potential and Likelihood/Exposure Graph

To illustrate integrating potential and exposure we return to the example concerning the agribusiness firm and the technology uncertainty it faced. The firm scored technology in the upper-right quadrant for the likelihood/potential graph i.e. high likelihood and high potential. Focused on this quadrant, recall that the exposure score and the likelihood of this exposure were high. This maps the technology uncertainty in the upper-right quadrant of the integrated likelihood/exposure graph. Visually in Figure 3, it can be seen that for potential, the quadrant is dark green representing an uncertainty that should be exploited by the firm, but the embedded likelihood/exposure graph indicates trouble (red color) because of the exposure faced from this uncertainty.

Uncertainty Management Strategies

So what does this analysis indicate management should do to manage the various types of uncertainty? As Baldoni (2004) indicates, many companies have identified the uncertainties their company faces, but do not have policies for mitigating the exposures or capturing the potential. The bottom graph in Figure 4 contains the integrated heat map with one or more of six generic strategies for managing the

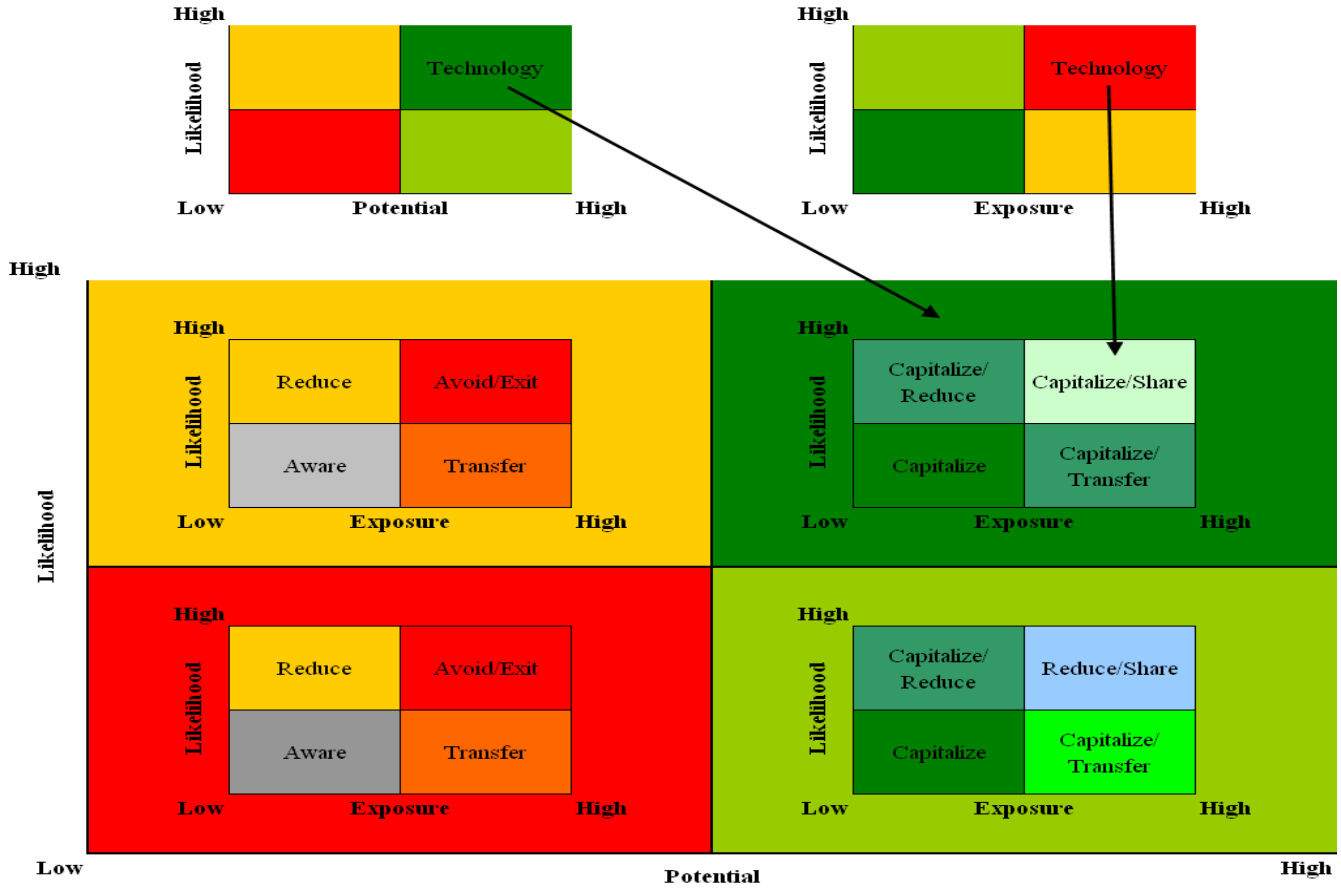


Figure 4: Generic Strategies for the Quadrants of the Integrated Likelihood/Potential and Likelihood/Exposure Graph with a Technology Uncertainty Example*

*Strategies adapted from Centrec Consulting Group LLC (2002)

uncertainty identified for each of the 16 quadrants. The generic strategies are capitalize, share, transfer, reduce, avoid, and monitor. 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. Specific actions are beyond the scope of this paper but are important for a companies' strategic decisions; see Trigeorgis (1995, 1996, 1999), Luehrman (1997, 1998a, 1998b), Courtney (2001), Mun (2003), and McGrath and MacMillan (2001) for a discussion of these choices and options.

The capitalize strategy applies to an uncertainty that has desirable potential with minimal exposure, i.e. *high potential + high likelihood of potential and low exposure + low likelihood of exposure*. Capitalizing on this uncertainty creates opportunities to generate economic profit. Here a firm might want to think about attempting to shape the future of the industry based upon their perceived advantage with this uncertainty. For example, a firm may want to enter a new market, introduce a new

product, or make an acquisition if the uncertainty is characterized the capitalize strategy.

In contrast, for an uncertainty, that has *low potential + low likelihood of potential* and *high exposure + high likelihood of exposure*; the strategy that should be employed is avoid. In essence, the consequences in this case warrant immediate exploration of actions to eliminate the uncertainty through some type of avoidance or exiting strategy. Perhaps the firm would want to consider a divesture of a business unit if multiple sources of uncertainty are heat mapped into this category.

Most strategic uncertainties are not easily managed with a capitalize or avoid strategy and present the greatest dilemma in strategic uncertainty management. A firm might want to share an uncertainty that has a desirable potential, yet creates adverse consequences. To mitigate these consequences, sharing the potential and exposure through joint ventures and strategic alliances is a possible strategy. Uncertainties where this type of strategy is most appropriate exhibit *high potential + high or low likelihood of potential* and *high exposure + high likelihood of exposure*.

Uncertainties which exhibit *low potential + high or low likelihood of potential* and *high exposure + low likelihood of exposure* should be managed with a transfer strategy. The transfer strategy is used because there are other institutions or firms that have better risk management capabilities for this strategic uncertainty. By outsourcing the exposure portion of the uncertainty to another entity, perhaps for example through the purchasing of weather derivatives, the firm is able to capture the potential while truncating their exposures to large losses.

The reduction strategy is preferred when exposure is very likely but the consequence is minimal; here, outsourcing is often difficult. For example, insurance firms may refuse to cover a trucking company whose drivers have a history of multiple auto accidents and frequently file claims. The reduction strategy is focused on decreasing the likelihood of exposure. For example, a firm might rely upon sequential decision-making -- making incremental investments as opposed to a full-scale investment -- that allows the firm to reserve the right to play if the market develops, but protects the firm if the market fails to materialize. This strategy is appropriate for uncertainties exhibiting *high or low potential + high or low likelihood of potential* and *low exposure + high likelihood of exposure*.

Monitor, the final strategy, is used to manage those uncertainties with *low potential + high or low likelihood of potential* and *low exposure + low likelihood of exposure*. This type of uncertainty warrants monitoring or the firm being aware of changes in the dimensions of the uncertainty. However, management efforts should be focused elsewhere, since impact on profit is minimal.

Let us return to the earlier example concerning technology to illustrate the application of these concepts (see Figure 4). The generic strategy appropriate to manage the technology uncertainty is the capitalize/share strategy. The capitalize strategy indicates that the firm wants to capture the potential of the uncertainty if possible, but the heat map indicates that the firm should consider transferring at least part of the uncertainty to another entity. A possible share strategy would be acquiring licensing agreements with several smaller independent R&D firms to access their technology platforms while maintaining their own platform. This allows the firm to maintain their technology potential while minimizing the tunnel vision and obsolescence problem that could arise if they relied solely on their own technology. In essence, if one of the contracted firms develops a platform that the market desires, the licensing agreement enables access to that platform, thus mitigating the exposure from technological obsolescence.

Application of the Scorecard and Heat Map

To test the applicability of the aforementioned methods for assessing and communicating the challenges and opportunities of strategic uncertainty, the concepts and tools were presented and discussed with participants at the 2005 American Seed Trade Association Advanced Management (ASTAAM) Forum -- an advanced management forum sponsored by Purdue University's Center for Food and Agricultural Business in conjunction with the American Seed Trade Association's Management Skills Committee. Participants in this forum ranged from a Contract Business Development Manager to the President/CEO of a seed company. In addition, the size of the companies varied from privately held firms to publicly traded multi-national firms. This diversity led to a rich discussion of the assessment tools and concepts as well as their usefulness in a company's strategic planning process.

The assessment concepts and tools were presented to the participants in a classroom teaching session in conjunction with three vignettes (hypothetical seed companies) to assist in the learning and application of the concepts. Figure 5 provides the vignettes used for the application activity. The initial workshop session introduced the sources of uncertainty and the scorecarding concepts, and then the participants were assigned one of the three case vignettes and asked to complete a scorecard for that vignette. Upon completion of the individual assessment, participants were grouped by vignette and asked to develop a consensus or group scorecard. Each group then provided a synopsis of their completed assessment and reasons for scorecarding the strategic uncertainties for their group's vignette.

Upon completion of the group presentations and discussion of their consensus scorecards, the participants were introduced to the heat map and the six generic management strategies. The participants then used the consensus scorecard they

Company #1 – Regional Midwestern Seed Company

- Corn and Soybean products with latest technology
- 3 states (Illinois, Indiana, Ohio)
- Direct sales to customers
- Market share hovering around 8 percent
- Technology purchased from others under license agreements
- Family-owned business
- \$10,000,000 in Assets
- Debt-to-Asset Ratio of 50%
- Return on Equity averaging 8-10% last 5 years

Company #2 – National (US) Vegetable Seed Company

- Large selection of vegetable seeds with latest technology
- Independent dealerships in all major growing areas
- Market share near 30 percent
- Technology acquired through JV with R&D company
- Currently engaged in a JV with a vegetable processor to develop new varieties specific niche markets
- Closely held LLC
- \$100,000,000 in Assets
- Debt-to-Asset Ratio of 65%
- Return on Equity average 12-15% last 5 years

Company #3 – Multinational Seed Company

- Division of large Chemical Company
- All major types of seed (corn, beans, cotton, rice, wheat, vegetables, forages, etc.)
- Multiple distribution channels
- Market share in North America is strong in commodities (near 30% in corn, beans, cotton)
- Market share in North America is about 15% in vegetables and forages
- R&D activities for commodities is done in-house
- R&D activities for vegetables and forages are purchased from either their wholly owned subsidiary or others depending on the need.
- Public traded company
- \$1 Billion in assets
- \$300 Million in Debt
- Stockholder returns averaging 10 percent over the last 5 years

Figure 5: Vignette Descriptions

had developed in the prior session to develop a heat map for their vignette. After viewing the heat map, each group was asked to choose the two uncertainties on which their case firm should concentrate their management efforts, and suggest and justify specific actions or activities to manage these uncertainties.

Application to the Regional Midwestern Seed Company

To illustrate the application of the concepts and the discussion and dialogue of the group from the educational session, we will highlight the group discussion of the Regional Midwestern Seed Company vignette. The group assigned to this vignette noted that when they began initial discussions there were large discrepancies in how each of them individually scorecarded the uncertainties. For example, one individual in the group argued that the financial uncertainty exhibited a high exposure with low potential because of the high debt-to-asset ratio. A second individual in the same group with experience in finance indicated, “if the firm’s debt cost them only 4 percent and they were generating an 8-10 percent Return on Equity (ROE), then the financial uncertainty had high potential and low exposure, especially given the information concerning market share.” After extensive discussion among the members in the group and the utilization of the group’s collective body of knowledge, they were able to reach the consensus scorecard found in Figure 6 for the Regional Midwestern Seed Company.

Strategic Uncertainty Assessment Scorecard for Potential

Categories of Strategic Uncertainty	Potential	Likelihood
Business/Operational	2.7	2.5
Financial	4.1	2.6
Market Conditions	4.8	4.3
Technology	4.3	3.9
Business Relationships	4	3
Policy & Regulation	2.3	1.6

Strategic Uncertainty Assessment Scorecard for Exposure

Categories of Strategic Uncertainty	Exposure	Likelihood
Business/Operational	4.6	4.1
Financial	2.9	4.2
Market Conditions	1.3	2.4
Technology	4.6	3.1
Business Relationships	4.1	3.8
Policy & Regulation	1.8	2.4

Figure 6: Consensus scorecard: Regional Midwestern Seed Company

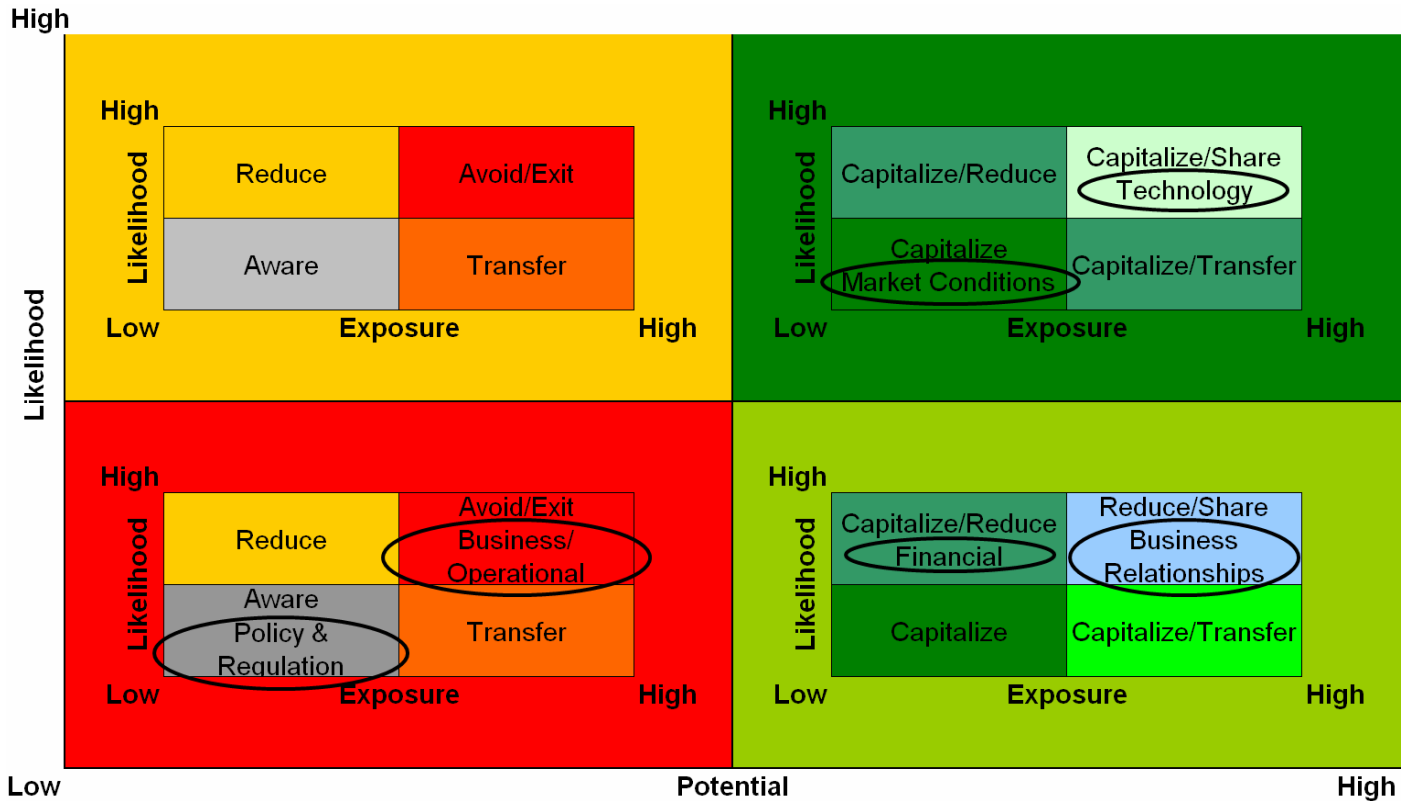


Figure 7: Suggested generic strategies for Regional Midwestern Seed Company

The group used the consensus scorecard to develop a heat map (Figure 7) and determine the two most pressing exposures facing the Regional Midwestern Seed Company. They began this exercise by working with the likelihood/potential and likelihood/exposure graphs (Figures 1 and 2). The group plotted each uncertainty into the appropriate quadrant based on the consensus scores. They noted that almost immediately the colors and hand signals in this graph generated conflicting messages about key uncertainties facing this firm. For example, the policy & regulation uncertainty is mapped in the lower left quadrant of the potential/likelihood graph (red color/ thumbs down). However, it is also mapped into the lower left quadrant of the exposure likelihood graph (green color/ thumbs up). Thus, the heat mapping indicates that as to exposure, this uncertainty presents no risk to the firm, but on the potential side the uncertainty is unlikely to generate any profit. The market conditions uncertainty was placed in the dark green/thumbs up quadrant for both the exposure and potential measures. Thus, an obvious choice for this uncertainty is to find a way for the firm to maintain their current position. Ultimately, the group agreed that technology uncertainty and business and operational uncertainty were the two most critical uncertainties to be managed.

Originally, the group thought that technology uncertainty could only have a negative impact on firm value; however, after the heat mapping process they

realized technology uncertainty had an upside that could not be overlooked. To determine how to manage this uncertainty the group superimposed the generic strategies for each quadrant onto the heat map. The suggested generic strategy for technology was capitalize/share. This generated intense discussion about the specific actions the firm should implement to capture the potential of the technology uncertainty while limiting its downside. They suggested that the firm consider developing multiple licensing arrangements with their technology suppliers. In addition, they felt that since the company has strong customer relationships, they could leverage this knowledge with these technology suppliers, thus providing the technology firms with information on what attributes the customer needs and wants in their seeds.

While the technology uncertainty had upside potential, the business and operational uncertainty had little or no upside potential and only generated detrimental consequences to the firm. The group concluded that the firm was not large enough to capitalize on the economies of scale available to larger seed companies who bagged and distributed multiple species of seeds. The generic strategy suggested by the heat map was avoid for the business and operational uncertainty, i.e. there was high likelihood of a large exposure and low likelihood of a high potential. With the generic strategy serving as a guide, the group suggested selling off the assets associated with the bagging and distribution facilities and using some of the proceeds to pay down debt to achieve a debt-to-asset ratio between 35-45%. The company should then focus on being a market driven company that worked more closely with their customers and technology suppliers to develop seed varieties valued in the market. They concluded that for a small seed company, customer relationships along with reputation and image have great potential. Meanwhile, the company could effectively contract with another firm to bag and ship the products at a cost level comparable to larger competitors on a per unit basis.

Participant Evaluations

The participants completed a workshop evaluation and provided additional written and verbal feedback on the assessment tools and concepts. Several of the participants indicated in their final evaluations that the strategic uncertainty assessment tools and concepts were useful in helping them understand and prioritize strategic uncertainty. These comments are reflected in the overall ranking for this workshop, which was 4.62 on a scale of 1 to 5, with a one being not relevant and a 5 being extremely relevant.

The participants indicated that the taxonomy encompasses most all uncertainties faced by firms, and a company could tailor the scorecard to meet the needs of their firm by adding or removing uncertainty categories. They also noted that the individual assessments, followed by the group discussion to build a consensus

scorecard proved invaluable in resolving the differences between viewpoints. This process was beneficial in obtaining a more complete understanding of the uncertainty facing the company in their vignette. One participant noted that after hearing the other members in his group discuss their scores, he changed his individual assessment of the uncertainty because his current functional responsibilities limited his ability to accurately assess properly the uncertainty in some areas.

The participants also valued the inclusion of potential and the likelihood of potential as dimensions in the scorecard. They indicated that it is very difficult to recognize the potential of an uncertainty when most of the past focus in managing uncertainty has emphasized exposure management. The inclusion of potential affected their prioritization in assessing and managing that uncertainty, i.e. when focusing only on the exposure measure many of the participants indicated they would want to avoid some uncertainties at all cost, but with the inclusion of the potential this was not the case.

The workshop participants indicated that the heat map with the embedded generic strategies for managing uncertainties visually communicated not only how important the uncertainty is to the company, but also gave them clear guidance on the strategy that should be taken to manage the uncertainty. One participant noted specifically that the six strategies focus efforts to a subset of the available options for managing the uncertainty.

Our *a priori* expectations were that most groups would determine that uncertainties with avoid or capitalize strategies would be the most vital to the company since these are the uncertainties that have the biggest impact on profitability. The presentations by the groups supported this expectation, with each group indicating that these uncertainties should be managed first. However, participants also indicated that without the guidance of the generic strategies they would have struggled in addressing the strategic uncertainty that did not have avoid or capitalize as the generic strategy. The other four generic strategies gave them direction in determining how they should manage uncertainty. Without these additional strategies the participants stated that their firm would often choose between the two extremes of avoid or capitalize strategy. Doing so limits the firm's ability to create value.

One of the participants summarized his perspective as follows:

“The uncertainty scorecard and heat map provides a framework that guides the business through the strategic planning process in a sequential manner as opposed to the more traditional brute force methods we have been using in our strategic planning sessions. In

addition, I found this method more succinct and time effective than the traditional strategy tools.”

A Final Comment

Agribusiness firms are increasingly facing more uncertainty, not just from changes in prices, costs, and productivity/efficiency, but also from dramatic changes in market conditions, competitor behavior, and government policy and regulations. Analyzing these new uncertainties is difficult and strategies to manage them are complex. Furthermore, these uncertainties provide opportunities to create value and enhance profits as well as expose the firm to significant losses.

A mental model for assisting in the assessment, management, and communication of these strategic uncertainties has been presented in this discussion. The concepts and tools use scorecarding and heat mapping to bring both structure and specificity to the subjective assessment of a firm’s strategic uncertainties. A primary focus of the tools is an explicit recognition of both the potential and exposure of the firm’s strategic uncertainty. A beta test of these concepts was completed at the ASTAAM Forum. The participants in the forum found that by focusing on the potential of the uncertainty and the likelihood of this potential as well as the exposure and the likelihood of exposure, they better understood the true impact uncertainty could have on their firm’s value. In addition, their perspective was that the methodology was not only an effective way to facilitate understanding of strategic uncertainty, but it also provided useful assessment tools that management can easily incorporate into their company’s strategic planning processes. The scorecard and heat mapping tools provide a time efficient and systematic method for analyzing as well as communicating the strategic uncertainties faced by the firm. Further development and testing is necessary and underway, but preliminary results suggest that the methodology is useful in understanding, analyzing, and communicating the potential as well as the exposure of strategic uncertainty.

References

- (2004). “Be Prepared,” *The Economist* 370(8359):12.
- Anthens, Gary H., (2004). “Managing IT Risk at Delta,” *Computerworld*, 38(19):34.
- Baldoni, Robert, (2001). “Financial Risk Management: Journey or Destination?” *Directorship*, 27(6):13-20.
- Boehlje, Michael, Allan W. Gray, and Joshua D. Detre, (2005). “Strategy Development in a Turbulent Business Climate: Concepts and Methods,” *International Food and Agribusiness Management Review*, 8(Issue 2):21-40.

- Buehler, Kevin S. and Gunnar Pritsch, (2004). "Running with Risk," *MicKinsey on Finance*, Winter: 7-11.
- Centrec Consulting Group, LLC (2002). "Assessing Risk in Production Agriculture."
- Courtney, Hugh, (2001). *20/20 Foresight Crafting Strategy in an Uncertain World*, Harvard Business School Press, Boston.
- Groth, John C., (1992). "Common-Sense Risk Assessment," *Management Decision*, 30(5):10.
- Hillson, David (2003). "Gaining Strategic Advantage," *Strategic Risk*, June: 27-28
- Knight, Frank (1921) *Risk, Uncertainty, and Profit*, Houghton Mifflin, Boston.
- Luehrman, Timothy A., (1998). "Strategy as a Portfolio of Real Options," *Harvard Business Review*, September-October.
- Luehrman, Timothy A. (1998). "Investment Opportunities as Real Options: Getting Started on the Numbers," *Harvard Business Review*, July-August.
- Luehrman, Timothy A., (1997). "What's It Worth: A General manager's Guide to Valuation," *Harvard Business Review*, May-June.
- McGrath, Rita Gunther and Ian MacMillan. (2001). *The Entrepreneurial Mindset*. Harvard Business School Press, Boston.
- Mun, Jonathan, (2002). *Real Options Analysis: Tools and Techniques for Valuing Strategic Investments & Decisions*, John Wiley & Sons, New York.
- Nottingham, Lucy, (1996). "Integrate Risk Management," *Canadian Business Review*, 23(2):26-29.
- Pascale, Richard T., Mark Millemann, and Linda Gioja. (2000). *Surfing the Edge of Chaos*, Three Rivers Press, New York.
- Talavera, P.G., (2004). "Evaluate Risk and Plan for the Unforeseen," *Hydrocarbon Processing*, February: 87-93.
- Teach, Edward, (1997). "Microsoft's Universe of Risk", *CFO*, (March): 69-71.
- Trigeorgis, Lenos, (1996). *Real Options: Managerial Flexibility and Strategy in Resource Allocation* Cambridge, Mass.: MIT Press.

Trigeorgis, Lenos, (1995). *Real Options in Capital Investment: Models, Strategies, and Applications*, Westport, Conn., Praeger.

Trigeorgis, Lenos, editor (1999). *Real Options and Business Strategy: Applications to Decision Making*, London, Risk Books.

Wilkerson, Ellis J., (2003). "Getting Back to Basics is Key to Hard Market Survival for Risk Mangers," *National Underwriter*, 107(14):39-40.