



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*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.*

**STRATEGY DEVELOPMENT IN A  
TURBULENT BUSINESS CLIMATE:  
CONCEPTS AND METHODS**

by

Michael Boehlje

Staff Paper # 03-06

May 2003

**Dept. of Agricultural Economics  
Purdue University**

*Purdue University is committed to the policy that all persons shall have equal access to its programs and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.*

# **STRATEGY DEVELOPMENT IN A TURBULENT BUSINESS CLIMATE: CONCEPTS AND METHODS**

by

Michael Boehlje

Department of Agricultural Economics, Purdue University

West Lafayette, Indiana 47907-2056

[boehljem@purdue.edu](mailto:boehljem@purdue.edu)

Staff Paper # 03-06

May 2003

## Abstract

The accelerating speed of change in the food and agribusiness industries is resulting in more risk and uncertainty – the future is becoming much less predictable. Not only is the future more uncertain, the drivers of that uncertainty are also changing – strategic risk which generally has a low probability of occurrence, but large consequences, is becoming an increasingly important component of the decision environment. Managing these risks requires not only new assessment tools such as scorecarding and mapping, but also more systematic decision frameworks that can be best structured as decision trees. And managing time to redefine a strategic choice in an uncertain environment into a growth, divest, exit, pause or follow-on option that truncates the loss exposure and allows capture of the profit potential transforms strategy under uncertainty from a defensive posture of minimizing losses and protecting positions to an offensive posture of creating and capturing value.

Keywords: Uncertainty, real options, risk scorecarding, strategic risk, strategy development

Copyright © by Michael Boehlje. 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.

# Strategy Development in a Turbulent Business Climate: Concepts and Methods

by  
Michael Boehlje

Change and the uncertainty that results are not new to agriculture. But the rate of change appears to be accelerating. For example, biotechnology and genetic engineering have reduced the time lapse from trait identification to commercialization in corn genetics from 10-12 years to 7-8 years. The consolidation and restructuring of the food retailing industry has occurred very rapidly; consolidation of the chemical manufacturing and retail input supply industries has also occurred at an increasingly rapid pace. The rate of adoption of some new technologies such as biotechnology is much more rapid than that of the past as evidenced by adoption of hybrid corn.

Fine refers to the speed of change in an industry as “clockspeed”, and argues that competitive pressures and technological innovative as driven by more rapid scientific discovery has increased the rate of change in products, processes, and organizational structure. This increased rate of change, or “clockspeed” in 1) product and process innovation; 2) organizational structure in terms of mergers and acquisitions; and 3) reconfiguring of the supply/value chain through joint ventures, strategic alliances, acquisitions and other forms of vertical integration and coordination arrangements means that successful managers must be alert to the increasingly rapid changes in their customers and competition, the business climate, and the science and technology that underpin their business and industry.

Many perceive change and uncertainty as a threat, and there is a natural tendency to resist threatening environments. But change and uncertainty also provide opportunity, and anticipating them enables managers to not just adjust, but profit from them. In fact, the business community appears to be increasingly focused on “managed” risks providing opportunities (Pascale), whereas the capital markets have a much different perspective of risk as evidenced by the discounting and reduced value imposed on riskier projects or firms. This gap in perspectives of risk between business managers (entrepreneurs) and financial providers represents one of the more fundamental challenges in understanding uncertainty and its implications for the economic performance of the agricultural sector.

The purpose of this discussion is to present concepts and methods that might be used to frame and analyze strategic decisions in an environment of change and uncertainty. We will proceed by first identifying some concepts that may prove useful in framing and formulating these decisions. We will then briefly introduce and describe two analytical tools – scorecarding/mapping and a strategy decision tree – that can be used to assess strategic uncertainty and analyze alternative strategic directions in an uncertain environment. Finally, the challenge of identifying and creating real options as an approach to strategy development in turbulent times will be discussed.

## **New Perspectives on Uncertainty**

The rapid changes occurring in the agricultural sector have not just introduced more uncertainty in the industry, they have stimulated new perspectives that should be considered in framing and analyzing problems characterized by uncertainty.

### **Time and Uncertainty**

In a decision environment characterized by uncertainty, timing of decisions and managing time are critical to effective decision-making. Timing is particularly important in decisions that involve technological innovations and marketing positioning. As well documented in adoption studies, most new innovations involve a high degree of risk in terms of the potential payoff, but the innovator or early adaptor also typically has the highest potential to capture the most revenue or benefit from that innovation -- when everyone else is doing it, the incremental benefits from the new technology are marginalized. So adopting new technology earlier typically results in higher returns, but also higher loss exposure if the technology is inefficient or ineffective. Adoption late has lower loss exposure, but the payoff is typically small. In fact, the reason for adopting by late adopters may not be to increase profitability, but to just stay in business -- to survive.

Likewise in market positioning there is typically a first-mover advantage whereby the first to enter a market can establish a position that is difficult for competitors that follow to overcome. A quick follower may not lose a lot to a first-mover in market share and market positioning, but a late entrant typically can only grow volume and gain market share by offering superior products and services (which typically costs more and thus has lower margins), or by price cutting to “buy” market share which also pressures margins. Again timing is important in market positioning with the advantage typically being captured by those who enter or move early compared to those who delay and are late movers.

But first response (i.e., earlier compared to later) is not always best. There is also a phenomenon known as the follower’s advantage -- the benefits that a second mover can obtain by carefully monitoring the successes and failures of the early adopter or first mover and learning from those experiences. In fact, time and time delays can have real value. Many decisions, particularly major decisions involving the commitment of money and resources, can be made sequentially rather than all at once. Managing this sequencing process and taking advantage of time delays is critical to making decisions in an uncertain environment.

One effective way to manage time in an uncertain environment is to use time delays to gather additional information or to learn. New information might be of the following forms:

1. additional information about odds or chances (the probabilities) concerning the uncertain events that might occur, thus giving the decision-maker more confidence in the original estimates of the probability distribution.
2. changes in the environment surrounding the decision problem which alters the original probability distribution with some events becoming more likely and other events less likely.

3. changes in the accuracy of estimating the consequences or payoffs so that a more accurate decision problem and payoff matrix is used in the final analysis.
4. changes in the environment which actually alter the results or consequences of various decisions and, thus, increase or decrease the actual payoffs used in the analysis.

A related benefit of time delays is the learning that might occur during that delay. This concept of learning is beyond that of obtaining new information about the probabilities and consequences noted above. Learning involves new ways of thinking about the decision problem, new ways of framing and specifying the problem, new events that should be recognized, new sources of cost and revenues that should be considered in estimating the payoffs, or new uncontrollable variables that might impact the odds or chances of a specific event. Learning activities, thus, can result in: 1) respecification of the problem, 2) identification of new events or respecification of events, 3) estimation of new probability distributions for the events or the revision of those probability distributions, 4) identification of new actions or respecifications of actions, or 5) identification of new consequences or payoffs, or the respecification of payoffs. In essence, learning goes beyond obtaining new information, because it may result in the identification and definition of a new decision problem rather than simply a more accurate specification of the current problem.

### **Dynamic Uncertainty**

The typical way that uncertainty and the potential loss exposure that results are measured is the range or variability in particular events or outcomes. In addition to the variability in an outcome and the skewness in that variability, the pattern an uncertain or stochastic variable exhibits over time may also have significant implications for the risk a manager faces. For example, Figure 1 illustrates two different possible price patterns for corn over a period of time. Graph A shows random fluctuations in price with no extended sequential periods of high and low prices, whereas Graph B has a similar range in the fluctuations but exhibits a short sequential period of high prices and a much longer sequential period of low prices. The uncertainty faced by a manager and the availability of tools to manage those uncertainties are significantly different for these two sets of circumstances. For the price variability exhibited in Graph A, traditional hedging and forward pricing tools can be quite effective in reducing the potential loss exposure of low prices. It is more difficult to use these tools to manage the uncertainty reflected in Graph B of an extended period of time or a multi-year sequence of low prices; for example, forward pricing using futures or options markets for three to four years in the future is difficult if not impossible to use because such hedging instruments are not available that far into the future. In essence, a short period of high prices (or high payoffs in general) followed by an extended sequential period of low prices (low payoffs in general) is a much different and more difficult risk and uncertainty scenario to manage than one of random non-sequential fluctuations in prices or payoffs. Patterns of fluctuations in outcomes over time – whether they are random or time dependent (for example low for a long period) – will have an important impact on the magnitude of the loss exposure and the management strategy used to mitigate that exposure.

## **Sources of Uncertainty**

The risks and uncertainty faced in agriculture have often been classified into such categories as production, marketing, financial, legal and human risks (Banquet, et.al.). An alternative and possibly more useful taxonomy is to categorize risk and uncertainty as tactical/operational and strategic. As agriculture becomes more industrialized, strategic uncertainty is likely to become increasingly more important, and as we will note this uncertainty is typically more difficult to manage.

### **Tactical/Operational Risk and Uncertainty**

The traditional risk and uncertainty faced by farm and agribusiness firms can be categorized as business risk and financial risk. Business risk is commonly defined as the inherent uncertainty in the financial performance of the firm independent of the way it is financed. Thus, business risk includes those sources that would be present with zero or 100 percent equity financing. The major sources in any production period are price, cost, productivity and production uncertainty; a number of factors may affect this variability over time.

Financial risk or uncertainty is defined as the added variability of net returns to owner's equity that results from the financial obligation associated with debt financing. This risk results primarily from the use of debt as reflected by leverage; leverage multiplies the potential financial return or loss that will be generated with different levels of operating performance. Furthermore, there are other risks inherent in using debt. Uncertainty associated with the cost and availability of debt is reflected partly in fluctuations in interest rates for loans and partly through nonprice sources. Nonprice sources, a type of institutional uncertainty, include differing loan limits, security requirements, and maturities, which impact the availability of loan funds over time. Thus, financial risk also includes uncertain interest rates and uncertain loan availability.

### **Strategic Risk and Uncertainty**

The focus of strategic risk and uncertainty is the sensitivity of the strategic direction and the ultimate value of a company to inappropriate strategic choices, ineffective strategy implementations or uncertainties in the business climate. 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. Tactical or operational risk is easier to manage than strategic risk and uncertainty, in part because information is generally available to measure these risks, and because of the availability of accepted tools and techniques to transfer these risks to others, such as insurance and futures markets.

Most strategic risks cannot be managed or transferred through conventional futures or insurance instruments or markets. Strategic risk is multidimensional, so managers cannot assume the simple one-to-one mapping between exposures and hedging or insurance instruments. Creative strategies must be developed to manage strategic risk exposure; approaches include flexibility, adaptability, diversification and options.

To illustrate, one of the strategic uncertainties farmers are facing because of the industrialization of agriculture is contractual or relationship risk. The expanding use of contractual

agreements and other forms of negotiation-based linkages between the various stages within the agricultural production and distribution system, combined with the decline in impersonal, market-based transactions, results in price risk being replaced by relationship or contractual risk for many farm businesses. A grower may have a contract that guarantees a price for the crop, but what happens if the processor goes bankrupt? What happens to the contract (availability or terms) next year if the processor finds other suppliers in other areas who can satisfy their needs at a lower price? This risk is not unlike that of losing a landlord or a lender, but losing access to the product market has typically not been a significant risk in commodity based agriculture.

Another strategic risk that seems to be increasing in recent years is that of compliance or regulatory risk. Farm and agribusiness firms are facing increasing regulation in all aspects of their business transactions. Added to the traditional areas of regulation concerned with transportation, taxation and labor use are two rapidly growing regulatory areas: food safety/security and the environment.

### **The Domain of Risk and Uncertainty**

When viewed from the broader perspective of both strategic and tactical/operational risks, the total risk that farm and agribusiness firms face is much more complex and more pervasive than is often perceived. In fact, as the agricultural sector increasingly exhibits the characteristics of an industrial model, the types of risks it will face will also change. A taxonomy of the broader dimensions of risk that farm and agribusiness firms will be facing in the future is presented in Figure 2. From both an analytical and managerial perspective, a major challenge in the future will be to quantify both the frequency or probability of occurrence and the magnitude of exposure from each of these potential sources of risk.

### **Options Thinking**

Options theory provides a conceptual framework for measuring and pricing risk, and it is widely used in financial markets to transfer and price interest rate, foreign exchange rate, commodity price, stock price and other risks through both organized futures and options exchanges and privately negotiated arrangements such as strips and swaps in the financial markets. More recently the concepts of options theory have been extended beyond the financial markets to investment and strategic decisions in an uncertain environment -- real options (Dixit and Pindyck, Amran and Kulatilaka).

The basic premise of real options theory is that many investments (as well as most strategic decisions) involve risk and uncertainty concerning future payoffs and costs, but the decision can often be divided into stages and sequenced so that more information is available after the first stage which will influence the probability as well as the potential size of the expected payoff. In these circumstances, the initial stage investment or commitment is much like buying a call or an option, i.e. the opportunity but not the obligation to make additional investments or commitments at a later stage.

Options thinking explicitly considers the benefits of delaying a decision or financial commitment in an uncertain environment. In essence, there are two financial benefits of any delay in committing funds. First is the interest or earnings received on those funds not committed but instead

invested elsewhere while one waits. This benefit accrues no matter what happens to the risk or uncertainty during the delay. A second benefit of delaying is that in most cases additional information can be gathered, or a more detailed analysis can be completed that will increase the certainty about the future costs and benefits that result from the decision or investment commitment.

Delaying has a benefit irrespective of what one finds out about the payoff -- whether it is bigger than originally thought or smaller than originally anticipated. And the more uncertainty there is about that payoff (whether negative or positive), the larger the value of the option to delay making the investment or decision. In essence, delaying a decision to have more certainty about either good or bad events in the future has value for two reasons: 1) to capture the benefits of completing the investment if they are higher than expected, and 2) maintaining the flexibility to avoid a mistake if the benefits are not as high as expected. Having the opportunity to obtain more accurate information about the future is valuable, even if that future is negative.

Real options concepts have the potential to be very useful in analysis of strategic risks in particular. For example, decisions concerning the profitability of capital investments including R&D expenditures, and the timing and staging or sequencing of such decisions in an uncertain environment, can be best understood as a real options problem. Such concepts can also be used to determine the optimal timing and sequencing of investments such as land purchases, large scale new venture livestock production facilities or company acquisitions.

Real options theory also may be useful to understand and evaluate the payoffs and risk of joint ventures and strategic alliances. A number of alliances, joint ventures and similar vertical linkages have been formed recently in the grain and input supply industries. Licensing and other agreements are increasingly dominating the biotechnology industry. From a strategic positioning perspective such arrangements compared to acquisitions might be viewed as acquiring an option, or as a preemptive move, yet maintaining flexibility until new information is available. Folta and Miller have applied real options theory to strategic alliances in the biotechnology industry. In similar fashion real options concepts maybe useful in understanding recent developments to form downstream linkages in the grain and oilseeds industries.

Assessing the potential payoff for a producer to invest in information documenting/monitoring and measuring systems for crop and livestock production is also a problem best analyzed with a real options framework. Generally, data on production and growing conditions that is not captured and catalogued cannot be recreated later, or only at significant cost. The value of that data (i.e. the value of information) may be uncertain at the time of capture, so a traditional investment analysis may suggest the benefits do not exceed the outlay. For example, GPS driven precision farming data on yields may not inform sufficient improvement in agronomic practices to create a benefit stream of reduced costs and increased efficiency to justify the resource commitment. But if the information system creates the prospects of a new venture such as producing higher valued products for a processor who requires documentation, or accelerates endogenous learning that improves efficiency and productivity more rapidly than would occur without the information system, the investment has created options that when valued with real options analysis techniques may significantly increase the expected payoff from the investment.

Assessing the potential of financial institutions investing marketing resources to attain a specific customer segment is also best framed as a real options problem. Some customer segments –

for example home purchasers who desire a mortgage – may generate a current and future net revenue stream depending on the size of their current and expected future activity – mortgage loans as the homeowner moves to more expensive houses. This potential is commonly evaluated with customer lifetime analysis procedures. Other potential customers such as small businesses may need an expanded product line of financial products and services over time – loans, cash management, payroll services, asset management and investment services, trust services, etc. Informed analysis of the potential of this traditionally described “cross-selling” activity can be framed as a real options problem where acquiring the customer today with a loan or cash management product/service creates option potential for related products and services in the future. Assessment of lost-leader marketing strategies and price discounting or pricing below cost to enter new markets or maintain market share also might best be framed as real options problems.

Options concepts may also be useful in making decisions to enter new businesses such as production of specialty crops. In most cases, transitioning from commodity crop production to specialty crop production involves sequential investments in increasingly specialized machinery and equipment in an uncertain environment concerning future growth in demand, price premiums, yield drag, etc. If the required investment must be made up-front with limited capacity to make adjustments, the expected benefit stream or the expected payoff may not justify the outlay. But if critical investments such as storage facilities for identity preservation can be made in the first year – and specialized planting, pest control and harvesting equipment investments delayed for a year or two until new information is available on the magnitude of the price premium or yield drag for example, the option value of delaying part of the investment outlay plus buying time to obtain more certainty about future payoffs may convert an unacceptable business venture into one that is acceptable. An example of sequential expansion in livestock facilities would be constructing finishing barns initially, and then a breeding/gestation/nursery unit two or three years later if initial uncertainty concerning pork prices and feed costs subsequently suggests that margins will be on the higher end of the original probability distribution function rather than the lower end of that function. These examples suggest not only the benefits of using the options approach to making investment or strategic decisions, but also indicate the value of making such decisions sequentially when possible.

### **Analytical Tools**

#### **Scorecarding/Mapping**

Traditional probability distribution techniques and more recent developments in application of value-at-risk and stress testing assume some form of objectively or subjectively determined probability distribution that can be used in the quantitative assessment of the risk exposure. But much of the uncertainty that is part of today’s agriculture can only be assessed qualitatively: sufficient numerical observations are not available to provide objective assessment of probabilities so as to develop market instruments for risk transfer and allocation, or use actuarial techniques to insure and mitigate risk. Although objective measurement of risk and uncertainty is preferred to subjective assessments, the increasing relative importance of subjective risks in agriculture suggests that they cannot be ignored because they can not be quantified. Until more objective evidence is available to build actuarially sound numerical estimates of risk, a systematic procedure to assess the frequency and consequences of these new uncertainties may be essential. This in fact is the emphasis of recent developments in scorecarding (Thornton).

Risk and uncertainty scorecarding is similar in approach to that of credit scorecarding used by lenders to assess the credit risk of various customers. The concept is to identify the potential sources of risk and uncertainty for a particular business, to assess the severity of those risks in terms of probability of occurrence and magnitude of consequence and to map this assessment into a management strategies matrix. Figures 3 and 4 provide an assessment and mapping matrix tool that can be used to summarize the management implications of scorecarding. For each of the categories identified in Figure 3, the probability of occurrence and the magnitude of the potential consequences are evaluated on a scale of 1 to 5 with 1 defined as low and 5 as high for each scale. These numbers are recorded in Figure 3. A pair of numbers can then assess each category for a specific business. For example, (2, 4) would indicate a ranking of 2 on the probability of occurrence scale and 4 on the potential consequences scale. This pair of numbers then provides the coordinates to visualize that particular category of risk and uncertainty in the graph of Figure 4. Example assessment numbers have been assigned to the fourteen different categories to illustrate how they can be visualized by their score coordinates in Figure 4.

The different categories of risk and uncertainty are reflected by their coordinates in the graph of Figure 4 along with the general strategies that can be used to manage the potential loss exposure. The assessment provided by the graphical images of Figure 4 are that the most vulnerabilities that this business faces are from business partners and partnerships (category 6), and possibly the dated nature of the technology used by the business (category 14). Most of the other loss exposures can be either retained or readily transferred/shared with appropriate market or other instruments. Note how this graphical representation provides a useful and meaningful synopsis of the many dimensions of the uncertainty faced by the business and can be used to assess not only the key sources of exposure or vulnerability, but also how they can be managed.

### **A Decision Model**

Developing strategy in an uncertain business climate is a complex and ambiguous process. One way to frame this process is to use a decision tree. The decision tree of Figure 5 builds on concepts developed by Courtney. Courtney identifies four levels of strategic uncertainty: 1) a clear enough future where a single forecast of the future business environment is sufficiently narrow to point to a single strategic direction; 2) alternative futures where the business environment can be delineated in a few discrete scenarios; 3) a range of futures where the business environment can be defined by the range of alternative futures, but not by a discrete set of scenarios; 4) and true ambiguity where the future business environment is essentially impossible to predict. Different approaches to making strategic decisions are most useful depending upon the different levels of uncertainty in the future business environment.

If a clear enough future has been identified, the decision environment contains little if any risk and uncertainty and an optimizing decision is possible. However, the payoff in this situation is likely to be modest since the uncertainty of the strategic choice is relatively low. Although true ambiguity is certainly a possibility, one of the first challenges and tasks of successful managers is to analyze the future with a focus on converting a decision environment of true ambiguity to one of at least a range of futures if not alternative futures. This process of delineating the domain or space of the uncertain environment will often assist the decision-maker in pruning the decision choices to a relevant set.

Courtney suggests that developing strategy in an uncertain environment is a two-stage process: first, choosing a strategic posture which defines the intent of strategy; and, second, selecting a portfolio of actions that are the specific moves or activities that can be used to implement the strategy. Three strategic postures are identified: 1) shaping the future where the decision-maker attempts to drive the industry toward a new structure of their own design, 2) adapting to the future where one takes the current and future structure of the industry as given and reacts to the opportunities that structure offers, and 3) a wait-and-see approach where one reserves the right to play by making incremental resource commitments to enhance one's ability to be a successful market participant in the future. These different strategic postures are illustrated in the decision tree of Figure 5.

Once a strategic posture has been selected three different types of actions or moves can be made to implement the strategy: 1) no regrets moves that are expected to pay off no matter what future comes to pass; 2) an option which is designed to secure high payoffs in the best-case scenarios while minimizing losses in worst-case scenarios; and 3) a big bet which involves large commitments of resources that will either pay off big or lose big.

Some examples may illustrate the usefulness of this decision framework. Consider the dilemma of a retail agricultural chemical supplier who is trying to decide whether or not to introduce precision farming and variable rate application services to its customers. The level of uncertainty of the effectiveness of variable rate technology is probably best characterized as one of alternative futures with three scenarios: 1) it in general is not cost-effective, 2) it is cost-effective for most customers, and 3) it is cost-effective only for those customers who have highly variable soils. The strategic postures might be to shape the market by being a market leader, with the action being a big bet start-up of a new division to provide the full spectrum of precision farming services. Alternatively, a posture of adapting to the future might be implemented with a no regrets move action of investing in personnel and equipment for soil testing and yield mapping that could be used to support an expanded precision farming program including variable rate application, or could be used to improve the quality of recommendations, service and application with standard equipment. A reserve the right to play posture might be implemented with a set of actions that involve insourcing the analysis activity as described above, and outsourcing variable rate applications of chemicals from a service company at a subsidized fee or cost for certain customers. This decision framework could also be used to evaluate the alternatives to be considered in another critical retail dealer decision -- the adoption of an e-commerce strategy.

The decision model is equally applicable to production and investment decisions. A key issue faced by many farmers is what strategy to use in expanding the land base in their business (rent vs. buy) given uncertainty about future prices and government programs. It is typically feasible to identify alternative scenarios for prices and government program payments that define the future, so some form of scenario analysis using game theory or option valuation approaches is typically applicable. A most likely strategic posture is to adapt to the future or reserve the right to play; a big bet move would be implemented with a land purchase decision; whereas a no regrets move might be implemented with a crop share lease where future risk of prices and government payments are shared between tenant and landlord. An option move might be implemented with a longer-term cash lease that includes an option premium and a right to purchase the property at some future period. Note that these different approaches to managing the strategic risk may be adopted by different players in the same market as a function of their financial condition and their risk attitudes.

An additional example illustrates how this decision model can be used to analyze and understand the current restructuring of the pork and dairy industries. With the profound changes in technology and rapid structural changes in these industries, the future may be best described as a range of business environments rather than specific alternative futures or true ambiguity. Given this level of uncertainty, some market participants have determined that they can shape the future of the industry by their decisions, particularly in the context of market size and structure, supply chain linkages and qualified supplier programs, geographic location, and quality and other product attributes. Thus, these firms have taken a shape the future strategic posture, and implemented that posture with big bet actions or moves that are in some cases preemptive in nature, and in other cases are focused on dominating a particular segment of the market. Recent examples of this strategic approach might be the backward integration of packers such as Smithfield into pork production, or forward vertically alliances in the milk industry between large scale producers, processors and food retailers.

### **Identifying and Creating Options**

As indicated earlier, an options mindset and options thinking is critical to successful management in turbulent times. Accurate analysis of real options opportunities is one of the important skills of options thinking and an options mindset. But an equally and maybe more important skill is that of identifying and creating real options. In fact, successful management in turbulent times may be more dependent on the creativity in designing, crafting and recognizing options as it is in the decision model to value and choose the correct strategy. We will briefly review here some of the concepts useful in framing that option recognition and design skill.

### **Option Topology and Categories**

Different categories of real options have been identified by various authors, but in general the following categorization appears to capture most of these classifications.

- 1) Growth/expansion options – This category would include alternatives for new markets, new products, new customers, and new ventures in general which become prospects or possibilities that would not be open or available without the initial commitment of resources.
- 2) Contract/divest options – This option category is characterized by the flexibility to reduce the commitment or divest of some of the resources at high residual values or minimum costs if unexpected events should occur.
- 3) Exit/abandon options – Although this category might be perceived to be a subset of the contract/divest category described earlier, exit or abandon options are different in that the option is exercised to mitigate substantial losses or loss exposures.
- 4) Pause/wait options – This category includes conscious deliberate decisions to delay action or a choice until a specified future event occurs at which time a choice will be made or a new choice set identified.

- 5) Sequence/follow-on options – In this category, decisions are consciously time sequenced to both minimize current commitments and maximize future opportunity.

This classification attempts to capture most single options; multiple interacting or embedded options that are in essence an option on an option would combine these various forms of individual options. Specific activities or actions that fit these various categories will be described later.

### **Portfolio of Options**

McGrath and MacMillian suggest that an important element of successful entrepreneurial behavior is identifying a portfolio of options. Their categorization of option alternatives is most useful in framing the growth/expand category described earlier. McGrath and MacMillian are particularly concerned about technical uncertainty and market uncertainty in their discussion of using an options mentality to frame entrepreneurial behavior. Given these two categories of uncertainty, they identify three types of options that an entrepreneur should include in his/her portfolio. Positioning options are included when technical feasibility is highly uncertain, a dominant standard or design does not exist, or regulatory acceptance is uncertain. Scouting options are characterized by uncertainty as to what market segments want in their product/service offering. Stepping-stone options are purposely positioned as experiments to learn and may involve sacrificial products and services that are likely to fail, but will reveal useful information about both technical performance and market acceptance. In the language of venture capitalists, the approach to stepping-stone options is “fail fast, fail cheap, try again”.

Figure 6 summarizes the McGrath and MacMillian portfolio approach to new business ventures that combines options with enhancement and program launches. In the spirit and context of a portfolio of alternatives, McGrath and MacMillian suggest that the successful entrepreneur must not just include enhancement and platform launches in his/her set of new business venture alternatives, but must include positioning, scouting and stepping-stone options as well. Once various dimensions of technical or market uncertainty are resolved, some options in the portfolio can be exercised and converted into launches while others are allowed to expire.

### **Activities**

The kinds of activities that might be considered in the process of designing and creating real options for agribusiness firms are summarized in Table 1. The activities identified in Table 1 should be viewed only as a partial list of the business decisions that could be framed with an options mindset. Yet the breadth of the activities noted is indicative of the fact that options thinking can be used in almost all functional areas of the business (note that the options approach to financing including the use of financial options – puts, calls, swaps, etc. and other option instruments including options to buy, sell, and convert -- are not included in Table 1).

Many of the historical real options applications have included asset acquisitions such as sequenced investments, leases with a formal or informal option to buy, excess capacity or peak load investments, and pre-emptive investments. Resource commitments to research and development activities, particularly basic R&D compared to applied and technology transfer R&D, can possibly be best viewed with an options mindset where new discoveries in basic science can open up numerous avenues for application and commercialization. The choice between various less than full

commitment business models such as joint ventures, strategic alliances, licensing agreements, etc. can be analyzed with an options framework where the purpose of the initial commitment is to facilitate endogenous learning and capture tacit knowledge that can be used to inform decisions about further resource commitments. From a different perspective, participating in a value chain as a qualified supplier or contract grower might be viewed as an option to access future opportunities in terms of new products, new markets, or new technology which might become available on an exclusive basis only for value chain partners. An options approach can readily be used to frame and inform new business venture decisions including start-ups and acquisitions, as well as technology adoption decisions.

Two areas where options thinking has significant unrecognized potential are in market development and information systems investment and deployment. With respect to market development, the logic of investing marketing resources to identify and sell to influencers can be most logically framed and analyzed as a real options decision where the high payoff potential is the incremental customers that the influencer impacts. Likewise, common marketing strategies including bundling, customer lifetime selling, loyalty programs and cross-selling in the financial services market can be logically analyzed as real options problems or issues.

With respect to information systems and technology, as suggested earlier a critical characteristic of information is that if it is not captured and cataloged when it appears or becomes available, it is frequently lost and not recoverable. Consequently, the payoff of gathering time-dimensioned information may not be readily apparent at the time of capture, but it may create opportunities which would be unavailable without that historical information. Such examples as documentation and traceability systems in the production and distribution industry, or data sets that allow data mining and use of techniques such as statistical process control to understand determinants of performance and implement continuous process improvement systems, are examples where the current benefits may be limited, but the future opportunities created are substantial and can only be assessed with an options framework. Similar arguments apply to resource commitments to knowledge and learning activities (whether experiential, real-time learning or formalized training and education) where the current and direct benefits may be limited but the future opportunity set is expanded dramatically.

### **A Final Comment**

The accelerating speed of change in the food and agribusiness industries is resulting in more risk and uncertainty – the future is becoming much less predictable. Not only is the future more uncertain, the drivers of that uncertainty are also changing – strategic risk which generally has a low probability of occurrence, but large consequences, is becoming an increasingly important component of the decision environment. Strategic risks have one overriding characteristic compared to traditional operational/tactical risks – they are more typically unforeseen – some might describe them as unanticipated surprises. Managing these risks requires not only new assessment tools such as scorecarding and mapping, but also more systematic decision frameworks that can be best structured as decision trees.

But possibly one of the most important dimensions of the increasingly turbulent business environment is the critical role that time and the proper management of time play in making strategic decisions. Traditional approaches to capturing the time dimension using dynamic modeling that

explicitly includes the impact of the future on current decisions as well as current choices on the future generally does not adequately capture the full impacts of the time dimension. Managing time not only allows one to systematically obtain new information about the decision problem or learn and use that new knowledge to redefine the problem, it also often enables one to transform a problem with significant loss exposure to one with limited exposure using options thinking. Managing time to redefine a strategic choice in an uncertain environment into a growth, divest, exit, pause or follow-on option that truncates the loss exposure and allows capture of the profit potential transforms strategy under uncertainty from a defensive posture of minimizing losses and protecting positions to an offensive posture of creating and capturing value.

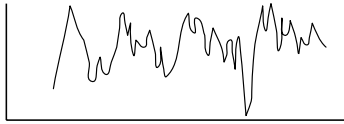
## References

- Amram, Martha and Nalin Kulatilaka,(1999). *Real Options: Managing Strategic Investment in an Uncertain World*, Boston: Harvard Business School Press.
- Banquet, *et.al.*, (1997). "Introduction to Risk Management," USDA Risk Management Agency.
- Copeland, T. and V. Antikarov (2001). *Real Options: A Practitioner's Guide*, New York: Texere, LLC.
- Courtney, Hugh, (2001). *20/20 Foresight Crafting Strategy in an Uncertain World*, Boston Harvard Business School Press.
- Davenport, T.H., Prusak L., Wilson J.H. (2003). Who's Bringing You Hot Ideas (and How are you Responding)? *Harvard Business Review* 81(2):53-+.
- Dixit, A.K. and Pindyck, R.S., (1994). *Investment under Uncertainty*. Princeton, NJ: Princeton University Press.
- Folta, T.B. and K.D. Miller, 2002. Real Options in Equity Partnerships. *Strategic Management Journal* 23(1):77-88.
- Kester, W. Carl, (1984). "Today's Options for Tomorrow's Growth," *Harvard Business Review* March-April.
- 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 MA.
- Mun, Johnathan, *Real Options Analysis: Tools and Techniques for Valuing Strategic Investments & Decisions*,
- Nichols N.A., Lewent, J. (1994). Scientific Management at Merck – An Interview with CFO Lewent, Judy. *Harvard Business Review* 72(1):88-&.
- Pascale, Richard T., Mark Millemann, and Linda Gioja, (2000). *Surfing the Edge of Chaos, The Laws of Nature and the New Laws of Business*, Three Rivers Press, New York.

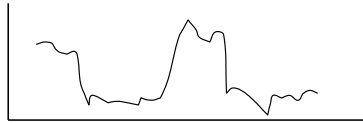
- Perry, (1989). Vertical Integration: Determinants and Effects, *Handbook of Industrial Organization*, Volume I, Elsevier.
- Robison, Lindon and Peter Barry, (1987). *The Competitive Firms Response to Risk*, Macmillan Publishing Company, New York.
- Rogers, E. (1995). *Diffusion of Innovations*. Fourth Edition. New York: Free Press.
- Schnitkey, Gary, Mario Miranda and Scott Irwin, AGRISK, <http://www-agecon.ag.ohio-state.edu/agrisk/agrisk.htm>
- Sunding, D., and D. Zilberman. (2001). The Agricultural Innovation Process: Research and Technology Adoption in a Changing Agricultural Sector. *The Handbook of Agricultural Economics*, G.C. Rausser and B. Gardner, eds. Amsterdam: North-Holland pp. 1-103.
- Sweetman, K. (2001). Embracing Uncertainty. *Mit Sloan Management Review* 43(1):8-9.
- Teach, Edward, (1997). "Microsofts Universe of Risk", CFO, pp. 69-71, March.
- Thornton, Emily, (2002). "A Yardstick for Corporate Risk", *BusinessWeek*, pp. 106-108, August 26.
- Trigeorgis, Lenos, (1996). *Real Options: Managerial Flexibility and Strategy in Resource Allocation* Cambridge, Mass.: MIT Press.
- Trigeorgis, Lenos, ed., (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.

# Figure 1 Dynamic Uncertainty

## A. Random Fluctuations



## B. Sequential Fluctuations



## Figure 2 Domain of Risk and Uncertainty

Categories of Risk	Illustrative Sources of Risk
Financing and Financial Structure	Debt servicing capacity, leverage, debt structure, nonequity financing, liquidity, solvency, profitability
Market Prices and Terms of Trade	Product price volatility, input price volatility, cost structure, contract terms, market outlets and access
Business Partners and Partnerships	Interdependency, confidentiality, cultural conflict, contractual risks
Competitors and Competition	Market share, pricing wars, industrial espionage, antitrust
Customers and Customer Relationships	Product liability, credit risk, poor market timing, inadequate customer support
Distribution Systems and Channels	Transportation, service availability, cost, dependence on distributors
People and Human Resources	Employees, independent contractors, training, staffing adequacy
Regulatory and Legislative	Export licensing, jurisdiction, reporting and compliance, environmental
Political	Civil unrest, war, terrorism, enforcement of intellectual property rights, change in leadership, revised economic policies
Reputation and Image	Corporate image, brands, reputations of key employees
Strategic Position and Flexibility	Mergers and acquisitions, joint ventures and alliances, resource allocation and planning, organizational agility
Technological	Complexity, obsolescence, workforce skill-sets
Financial Markets and	Foreign exchange, portfolio, cash, interest rate
Operations and Business Practices	Facilities, contractual risk, natural hazards, internal processes and controls

Adapted from Teach, Edward, "Microsoft's Universe of Risk" CFO, pp. 69-71, March 1997.

**Figure 3 Risk Exposure Scorecarding**

	Severity	
	Probability	Consequences
<b>Business/Operational</b>		
1. Operations and business practices		
2. People and human resources		
3. Strategic position and flexibility		
<b>Financial</b>		
4. Financing and financial structure		
5. Financial markets and instruments		
<b>Business Relationships</b>		
6. Business partners and partnerships		
7. Distribution systems and channels		
<b>Market Conditions</b>		
8. Market prices and terms of trade		
9. Competitors and competition		
10. Customers and customer relations		
11. Reputation and image		
<b>Policy and Regulation</b>		
12. Political factors		
13. Regulatory and legislative factors		
<b>Technology</b>		
14. Rate of change and innovation		

Figure 4. Mapping of Exposures and Management Strategies

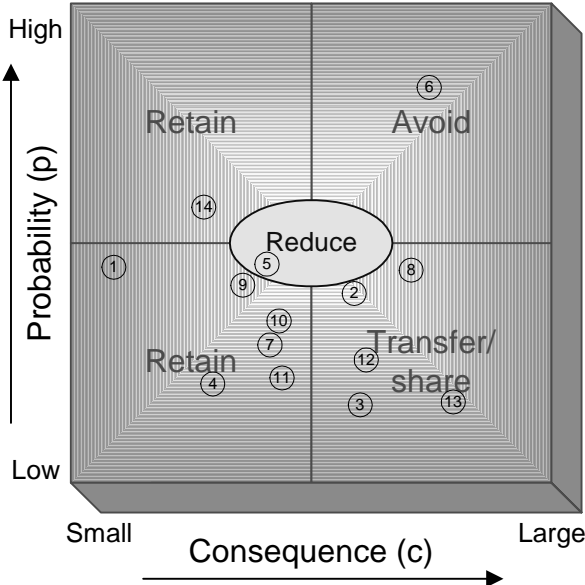


Figure 5. A Decision Tree of Strategic Choices in an Uncertain Environment

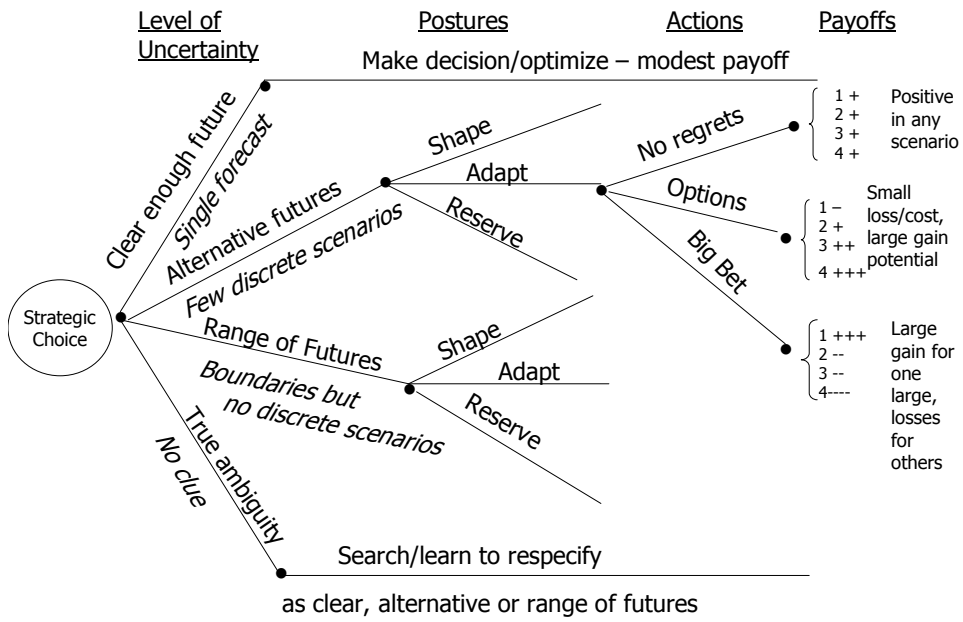


Figure 6. Building a Portfolio of Options

Technical Uncertainty	High	Positioning Options	Stepping Stone Options
	Low	Enhancement and Platform Launches	Scouting Options
		Low	High
		Market Uncertainty	

McGrath: The Entrepreneurial Mindset

**Table 1. Alternative Option Activities in Agribusiness**

- I. Asset Acquisitions
  - A. Sequenced investments
  - B. Leases
  - C. Excess capacity
  
- II. R&D Investments
  
- III. Business Models
  - A. Joint ventures
  - B. Strategic alliances
  - C. Licensing agreements
  - D. Contract production/qualified supplier
  
- IV. New Business Ventures
  - A. Start-ups
  - B. Acquisitions
  
- V. Technology Adoption
  
- VI. Market Development
  - A. Influencers
  - B. Bundling/cross-selling
  
- VII. Information Systems
  - A. Documentation/traceability
  - B. Knowledge/learning