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DETERMINANTS OF FIRM-LEVEL COORDINATION STRATEGY IN A CHANGING AGRI-FOOD SYSTEM

VOLUME I

By

Allen Francis Wysocki

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ABSTRACT

DETERMINANTS OF FIRM-LEVEL COORDINATION STRATEGY IN A CHANGING AGRI-FOOD SYSTEM

By

Allen Francis Wysocki

The purpose of this research is to develop a generalizable strategic decision-making framework that can be used to prescribe appropriate vertical coordination strategies for firms in the changing U.S. agri-food system. Central to the success of this framework is the ability to identify factors that determine when it is appropriate for firm-level decision makers to change from one vertical coordination strategy to another. Decision makers have options regarding choice of vertical coordination strategy (e.g., firms can decide to "go it alone" in the spot market, form a strategic alliance, or vertically integrate) and they need criteria by which to make these choices. This research postulates that the vertical coordination decision consists of one catalyst or stimulus, are coordination errors costly, and four decision nodes: (1) does an alternative reduce the costliness of a coordination error?, (2) is an alternative programmable?, (3) is an alternative implementable?, and (4) is the risk/return tradeoff associated with the alternative acceptable?

In creating this framework, the research presents a review of relevant literature in the fields of Agricultural Economics, Economics, Management, and Strategy. Building on this broad body of published work, a sequential decision making framework regarding the

choice of vertical coordination strategy is proposed and tested: (1) at the level of an industry for the Michigan seed potato, Wisconsin seed potato, and Michigan celery industries, and (2) at the individual decision maker level for producers within the Michigan seed potato and Michigan celery industries.

The validity of the four decision nodes and the resulting four research propositions were tested empirically through twenty five case studies, based on in-depth face-to-face interviews, the investigator's work experience and contact with the three industries, and phone calls made to professionals knowledgeable of the forces shaping these industries. Qualitative and quantitative analyses used to examine the data included a comparative analysis of the cases and discriminant analysis of the interview responses coded primarily as categorical variables.

Principle findings of the empirical research support the theoretic assertions of the overall framework. The reduction of a coordination error and the acceptability of the risk/return tradeoff were found to provide high explanatory power regarding the willingness or unwillingness of decision makers to change from their current vertical coordination strategy to an alternative strategy they had considered. The implementability of an alternative was found to provide additional explanatory power, but not to the same extent as costliness of fit or acceptability of the risk/return tradeoff. All the alternatives considered by decision makers in this research were found to be programmable, which did not allow for testing via discriminant analysis. This result suggests a change in research design or a reconstruction of the programmability variable to improve measurement ability. Further refinement and testing of each decision variables is warranted. A parallel decision making framework is offered as the next logical step in this line of inquiry.

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There are many people who deserve recognition for supporting me during these past six years as I endeavored to obtain the degree of Ph.D. Occasionally, I am asked if going back to school was a tough decision at 32 years of age with a wife and three children. My response comes easily and quickly when I tell my friends that the hardest decision was to leave the family potato business in Wisconsin. The decision to get the Ph.D. came after the decision to leave the family business. I would not have made this major decision if it wasn't for the support of Joan, my wife, our three amazing children, and the support of our immediate families.

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Thank you to Chris Peterson, my mentor and friend. I have really enjoyed participating in the deepening of our academic and personal friendship these past six years. Thank you for taking the time to develop my teaching skills, an area neglected all too

often in Ph.D. programs. I enjoyed the hours we have spent discussing agribusiness concepts and developing theory. Even though the job search has resulted in my taking a position at another university, I look forward to years of collaboration in our common pursuit of agribusiness research.

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1.1 Statement of the Research Issue

The purpose of this research is to develop a generalizable strategic decision-making framework that can be used to prescribe appropriate vertical coordination strategies for firms in the changing U.S. agri-food system. This research seeks to further refine the theory of the firm and its predictive ability. It is hoped this refined theory of the firm will become more beneficial to decision makers. Central to the success of this framework is the ability to identify factors that will cause firm-level decision makers to change from one vertical coordination strategy to another. Decision makers today have many options regarding vertical coordination strategy (e.g., firms can decide to "go it alone" in the spot market, form a strategic alliance, or vertically integrate) and they need a mechanism to assist decision making.

Besides determining when changing vertical coordination strategy is appropriate, agribusiness researchers need to get inside the "black box" of the firm to understand what motivates some decision makers to seek out alternative vertical coordination strategies, while others are satisfied with their current strategy. In particular, what encourages or discourages decision makers from adopting a "particular" vertical coordination strategy?

One goal of this research is to develop a framework that provides insight into the *process* of choosing a vertical coordination strategy. This should not be confused with *predicting* the dominant form of vertical coordination strategy from an industry or macro perspective. Many journal articles claim to provide theoretical explanations for vertical financial ownership. This assertion is often misleading. While motives provide explanations for vertical integration strategy, they do not necessarily provide insight on the choice of organizational form (Mahoney, 1992: p. 563). An even stronger point is made by Mahoney (1992) regarding the choice of organizational form:

> "In short, when we abstract from transactions costs, knowing the motive for vertical integration cannot help us in predicting or prescribing organizational form. Conversely, knowing the organizational form cannot help us to infer motive." p. 563

This research seeks to provide a better understanding of the managerial decision-making process as it relates to the choice of vertical coordination strategy.

1.1.1 *The Industrialization of Agriculture: Setting the Stage*

Fundamental changes are underway in the U.S. agri-food system, changes that are altering traditional marketing relationships. Parts of the food system are becoming tightly integrated (Barkema, 1993a). For example, the U.S. pork subsector is experiencing dramatic restructuring, including increased integration, during the 1990's. Economists call this restructuring the "industrialization of the pork industry." For purposes of this research, Sporleder (1992) and Barry (1995) refer to *agricultural industrialization* as:

- the increasing consolidation of agricultural production units (i.e., fewer and larger farms), and traditionally, the firms have
- provided undifferentiated products and services,
- in markets evolving toward, differentiated products and services,
- under a system of tighter vertical coordination.

This researcher has personally witnessed the industrialization process in the Wisconsin potato industry. The researcher's family potato operation continues to grow while many small growers have exited or will be forced to exit if low prices persist throughout the next marketing season. A partial explanation for the continued growth of this family potato operation was the decision to vertically integrate in the 1970's. The family shareholders own growing, packaging, and marketing interests in the potato industry for reducing risk and capturing the economic rent that traditionally went to non family interests.

In recent years, there has been an alteration of traditional marketing relationships linking consumers, food retailers, wholesalers, food processors, farmers, and ranchers (Barkema, 1993b). In the past, American agriculturalists produced and marketed commodities with broad quality characteristics that appealed to undifferentiated consumers. Agricultural producers operated in markets economists characterize as exhibiting "perfect competition." Today, most farm products are produced to meet specific customer needs. For example, a particular rice variety that meets the needs of a cereal manufacturer targeting adults may be unacceptable to a company making rice cereals for infants. These evolving marketing relationships now include specification contracts, strategic alliances, formal cooperative arrangements, and vertical integration, besides spot markets.

Agricultural firms find it increasingly important to decide which vertical coordination strategy to pursue. These vertical coordination decisions must be made both upstream and downstream. Further complicating this process is the fact that many firms employ multiple vertical coordination strategies. For example, a wheat grower may contract 80 percent of his crop to grain elevators and market the remaining 20 percent via the local spot market. This research recognizes the existence of these "hybrid" forms of vertical coordination strategy. However, this research focuses on "theory-building" versus "theory-disconfirming," therefore the resulting analytical framework is based on singular forms of vertical coordination strategy. This does not mean that hybrid forms of vertical coordination strategy have no place in this research. On the contrary, the proposed framework implicitly allows for hybrid forms of vertical coordination strategy as a risk management tool used to alter the risk/return tradeoff, to assess the ability of an alternative strategy to reduce the costliness of a coordination error, and to assess the implementability of alternative strategies. Additionally, hybrid forms of coordination strategy will be analyzed, if present, in the detailed case study analysis of this research.

Common themes of inquiry have arisen within the agricultural economics profession regarding the industrialization of agriculture and choice of organizational form. There are many competing viewpoints regarding the emerging forms of vertical coordination in the U.S. agri-food system. One view characterizes firms as collections of land, labor, and capital organized for the sole purpose of gaining market power (Barry, 1995; Handy and Padberg, 1977; Sporleder, 1994). Under this view, a firm's organizational form is adopted for its market power, and therefore, potential for profit. Barry (1995) offers the following comments regarding forms of vertical coordination and power:

> "Often, integration seems to reflect the mutual consent of equals in the case of 'bilateral negotiation,' In fact, however, the restructuring of the food system is not the coordination of units at similar levels of power. Rather integrators and integratees have different degrees of power. In poultry (perhaps the most mature 'industrialized food sector'), the integrator is always a large, powerful firm--typically a feed company in the early days of transition. In the later days of the transition, the integrator typically has been a poultry and meat product marketer. Only a few parts

of the sector were integrated early in the transition-production inputs (feed, pharmaceuticals, disease control, etc.), production and assembly. The feed company could effectively coordinate those parts. Later in the transition, marketers of poultry meat products and exporters integrated the earlier set of activities as well as genetics, hatching, slaughter, packaging, and marketing." p. 129

As Barry's comments point out, under this view, a firm's organizational form is adopted for its market power and control, and therefore, its potential for profit. Rogers and Caswell (1988: p. 7) argue that firms become conglomerates because further horizontal acquisitions are foreclosed by antitrust enforcement and because the conglomerate form allows them to engage in business strategies such as cross subsidization[1] that are unavailable to the single line firm.

Another view holds that "the modern corporation is mainly to be understood as the product of a series of organizational innovations that reduce transactions costs" (Williamson, 1981: p. 1537). The choice of vertical coordination strategy depends on reducing overall transaction costs. The transactions cost view is based on the work of Williamson and Coase. Transaction cost economics offers a unique perspective on industrialization as it relates to choice of organizational form and will be presented in greater detail in the next chapter.

There are other competing theories of the firm that may, in part, explain why different organizational forms exist. This research recognizes the contributions and limitations of each of these competing theories. For example, Dietrich (1994) in his book, *Transaction Cost Economics and Beyond: Towards a New Economics of the Firm*, criticizes transaction cost economics as telling only half of the story by not including the

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[1]The concept of cross subsidization is a combination of what Pearce and Robinson (1992) label as concentric diversification (the acquisition of businesses that are related to the acquiring firm in terms of technology, markets or products) and conglomerate diversification (the acquiring of businesses because they represent promising investment opportunities).

benefits from resource allocation in the analysis. In the next chapter, most of the competing theories are presented and combined (including the benefits associated with various organizational forms) to create a complete and adaptable theory regarding choice of vertical coordination strategy.

1.1.1.1 *Recent developments in vertical coordination*

The recent growth of vertical coordination in agriculture can be attributed to a complex set of domestic and international factors (Barkema and Cook, 1993 and 1993b; Barkema, Drabenstott, and Welch, 1991; Schertz and Daft, 1994) including: (1) changes in consumer and producer characteristics (including new technologies in production), (2) institutional change in the food system, (3) the growing importance of information and the quest for efficiency, and (4) more effective risk management and new financing arrangements. These four factors are discussed below.

1.1.1.1.1 Changes in consumer and producer characteristics

Industrialization has never been built on pareto optimal changes (Rhodes, 1993). Some people lose (Midwest hog producers as argued by some) while others gain (North Carolina hog production factories). A product of the industrialization of agriculture is the new consumer and new producer. In the traditional marketing system, bulk farm commodities flowed into the processing sector through traditional commodity markets. Consumers accepted food products with widely varying quality characteristics and then transformed them into meals in their own kitchens.

Major changes in consumer characteristics have reflected accelerated lifestyles, nutrition and a health awareness, needs for greater convenience, and a more diverse population (Senauer, Asp, and Kinsey, 1991). These changes have lead to a widening variety of food products, and a greater emphasis on targeting food products to clearly defined market niches. Greater emphasis on quality-related specifications of agricultural production is also occurring (Barry, 1995). In the changing agri-food system, farm products flow into the processing sector through narrower market channels. These channels are narrower because consumers' food needs are more specific and numerous (Powell, 1987: p. 78; Barkema, 1994). Pushing the value-added process back to the farm gate triggers fundamental changes in the food marketing chain.

Changing consumers

Consumers drive the U.S. agri-food system today. Until the mid 1980's, manufacturers had considerable influence on new product development. Typically, consumers were exposed to new products determined by the goods and services manufacturers produced. Consumers have become more discriminating, requiring the food industry to design its products more carefully, and they expect quality control and products with specific characteristics (Drabenstott, 1994; Boehlje, Ackridge, and Downey 1995). Manufacturers can no longer launch broad standardized products at a mass market and be assured of marketing success.

Strong demographic trends have led to a shortening of the time consumers are willing to spend preparing meals (due in part to increasing value of time), and an increased concern for nutritious, safe, convenient, diverse, affordable products and services. Greater coordination among the stages of the food system is required to respond directly to these preferences (Barry, Sonka, and Lajili, 1992). In fact, greater emphasis on contracting and vertical integration is one means of more effectively transmitting consumer preferences throughout the food system so that product specifications coincide with consumer demands. The role of signal transmission as it relates to the need for final consumer responsiveness and the proposed framework is presented in the following chapter.

Changing producers

Producers have the ability to respond to these ever-changing consumer demands. Advances in technology are giving agriculture the means to tailor its products to meet the consumers' more discriminating tastes (Barkema, 1994). For example, Andrew Smith, a California-based celery producer/shipper has decided to target precut produce processors by offering celery that is eight inches longer than normal celery. Fresh cut processors find this extra long celery useful (they are willing to pay a premium for this product) because of the increased yield, consisting of two additional four-inch celery sticks that can be made from the longer celery.

Barkema and Cook (1993b) offer another example of how producers have been adapting to changing consumer preferences:

> "Advances in technology have enabled the broiler industry, the pork industry, and other agricultural sectors to better tailor production to new consumer characteristics through various types of contractual arrangements. In the case of pork, the product engineering process begins at the hog production level. Improvements in measurement techniques, quality control, health systems, reproductive technologies, nutrition, and other computer-based technology have led to consistently leaner, more uniform, and similar sizes of animals." p. 130

The introduction of new technology continues to increase at an increasing rate. This will place considerable pressures on producers to learn how to use information systems if they hope to remain "capable" of meeting changing consumer tastes. For example, an Internet startup company called Syncra Software, Inc. will introduce a Java-based application that works with supply chain applications to alert trading partners to unexpected variations in supply chain processes, such as out-of-stock items, excess inventory, and changes in delivery schedules (Information Week Daily June 8, 1998).

Conclusions regarding changing consumers and producers

More demanding consumers and better equipped producers are changing the U.S. agri-food system. However, this situation requires producers to move from being production focused to becoming more marketing oriented. If the U.S. agri-food system is evolving toward a more demanding consumer and a more capable producer, one might expect this to be a perfect marriage. However, the traditional markets that moved food from farmer to consumer have not brokered these kinds of marriages very well (Drabenstott, 1994). This research recognizes the importance of studying the entire continuum of vertical coordination strategies available to agricultural producers for meeting changing consumer needs.

1.1.1.1.2 Institutional change in the food system

A food market of many niches implies that food companies must develop products carefully to hit smaller targets. New technologies provide exactly the product control that these food companies need. Barkema and Drabenstott (1995) illustrate these points by a graphic that compares the structure of the traditional U.S. food marketing system to the new food marketing system (see Figure 1.1).

In the traditional system, bulk farm commodities flowed into the processing sector through traditional commodity markets. The commodity hopper was wide because quality standards were wide. In the new food system, farm products flow into the processing sector through narrower market channels. The channels are narrower because the consumers' food specifications are more detailed.

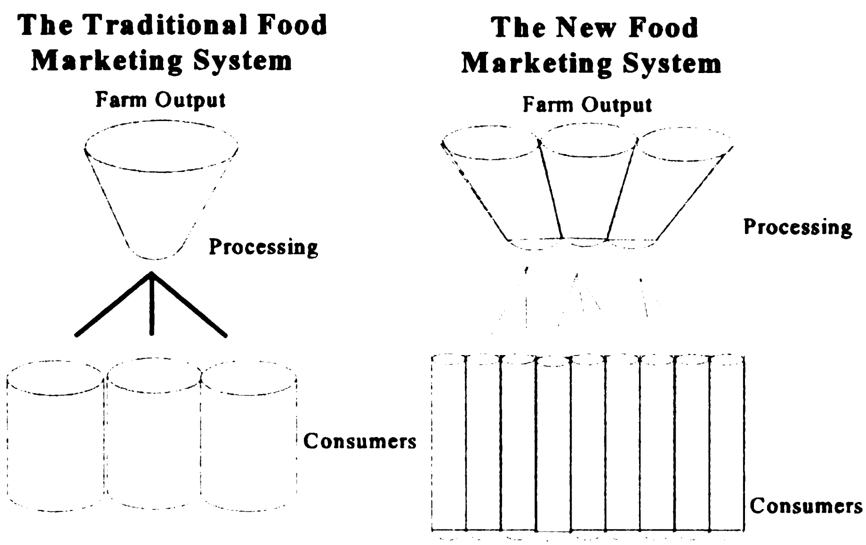

Figure 1.1 A Comparison Between the Traditional and New Food Marketing Systems

Source: Adapted from Barkema and Drabenstott, 1995: p. 485

Figure 1.1 highlights the role of institutional and structural change on vertical coordination decision making. Producers must adapt their way of conducting business, including their choice of vertical coordination strategy. Many smaller diameter hoppers of Figure 1.1 require vertical coordination strategies other than the spot market. An agricultural producer who is unable or unwilling to adapt to this evolving institutional structure is unlikely to survive.

1.1.1.1.3 The growing importance of information and the quest for efficiency

Firms that develop proficiencies in the gathering, interpreting, and dissemination of information, gain competitive advantage in the marketplace. Developments in information technology and systems can: (1) improve a firm's internal management systems, (2) further enabling the management of extensive interests, (3) ease the firm's administrative burden, and (4) further encourage internal coordination (Barkema and Drabenstott, 1995).

While the proper use of information is growing in importance, one should not assume vertical integration is the best coordination strategy to take advantage of the advances in information technology. Developments in information technology, which improve market information systems, can favor external coordination by making previously complex transactions routine.

In today's fast paced world "information truly is power." This research treats the ability to effectively implement information technology and skillfully disseminate the knowledge acquired as a resource and source of standalone competitive advantage. In essence, one primary impact of information technology is its effect on the marginal value product from combined activities at the transaction interface.

One by-product of the industrialization of agriculture is closer linkages with fewer suppliers, who in turn, provide products with specific attributes, which results in increased efficiency. Contract production, as well as other non-spot market forms of vertical coordination are intended to capture these efficiencies. For example, having a few contracts with large producers may be more efficient for processors than many contracts with smaller producers. However, excessive contract concentration could be risk increasing (Barkema and Cook, 1993a). The vast majority of vertical coordination strategies in the future will apparently be based on linkages designed to take advantage of information technology as a method for increasing efficiency.

1.1.1.1.4 <u>More effective risk management and new financing arrangements</u>

Increasingly, processors need a steady supply of known inputs to consistently utilize their plants at optimum capacity and to obtain expansion in product markets, both domestic and international markets. They must deal with high fixed costs and inflexibilities in scheduling related to wage contracts. Fewer sources of supply resulting from consolidation will increase the importance of continuous marketing relationships with larger producers. Some types of risk (e.g., price risk, production variability) may decrease while others, associated with increased size and specialization, will increase. The latter will likely result in higher capitalization requirements, specialized assets, higher and more rigid labor and management compensation, and reduced flexibility in production plans (Barry, 1995). The proposed framework explicitly considers various types of risk and uncertainty in combination with expected profit to form the risk/return tradeoff. Barry alludes to a key point regarding the ability to be responsive to final consumers. The same forces causing firms to explore non-spot market forms of vertical coordination, may also lead a firm to invest in highly specialized assets which could lead to inflexibility, asset rigidity, and the inability to be responsive to final consumers. Although the previous example focused on reduced sources of supply, these forces are likely to affect both sides of the transaction (e.g., both buyers and sellers of commodities). There are fewer processors and retailer buyers today, just as there are fewer producers. This implies, actors on both sides of a transaction will need to invest in more effective risk management and alternative financing arrangements, which could lead to inflexibility and the inability to be responsive.

The employment of highly specialized assets imply the need for capital. Financing requirements for acquiring capital assets, operating inputs, managing inventories, and other purposes also are influencing vertical coordination decisions (Barry, Sonka, and Lajili, 1992). This research posits that the absolute level, as well as, access to capital is one factor that affects the implemmentability of alternative vertical coordination strategies. Again, these issues are covered in greater detail in the next chapter.

Concluding remarks regarding recent developments in vertical coordination from an agricultural perspective

The changing nature of coordination between stages/processes within the agri-food system has generated many questions, and relatively few answers. Michael Boehlje summed up these changes and the current stream of agribusiness research questions in a 1994 Purdue staff paper:

> "(1) When and under what conditions will contractual or ownership coordination occur? (2) What stages of the food chain will be linked through such coordination mechanisms? (3) Who will have the most control/power in the contractual or ownership coordinated system? (4) How will the risk and rewards be shared among various participants in the contractual/ownership coordinated system? (5) What concepts are available to evaluate and understand these changes and provide answers to the above questions." p. 3

This research suggests a general theory for predicting and prescribing various strategic options within a vertical coordination continuum. The proposed framework will integrate and extend previous work done within transaction cost economics, agency theory, strategic management, industrial organization, the resource-based theory of the firm, and the knowledge-based view of the firm.

Before the proposed framework is presented and the corresponding theoretical background is outlined, it is necessary to establish the notion of a vertical coordination continuum, as truly being a continuum of control. The remainder of this chapter is devoted to: (1) defining exchange relationships and their relevance to the continuum, and (2) the definition and characteristics of the vertical coordination continuum.

1.2 Exchange Relationships and the Vertical Coordination Continuum

Given the interrelatedness of exchange relationships and the vertical coordination continuum (exchange relationships are carried out within the context of vertical coordination strategies), it is necessary to provide background information concerning exchange relationships and vertical coordination continuum.

1.2.1 Defining exchange relationships

Exchange can be defined as the transfer of goods, services, and money between individuals and firms. An *exchange relationship* (Pilling, et al., 1994; Easton and Araujo, 1994) describes more than a flow of goods, services, or money. It describes levels of openness, trust, cooperation, commitment, the sharing of information, and even coercion[2]. Traditional adversarial buyer-seller relationships, characterized by mutual distrust and asymmetric information (Rogers and Daugherty, 1995), are giving way to more cooperative forms of exchange relationships in agriculture. Increasingly, buyers and sellers are not *singularly* motivated to buy as cheaply and sell as high as possible. Today companies are trading short-run gains for anticipated long-run benefits from cooperation (Frank, 1988; Spekman, et al., 1996). Companies are sharing detailed proprietary information to serve consumer needs better and to gain marketplace advantage.

Specific exchange relationships fall under a broader category of possible coordination strategies. The study of vertical coordination emerged in the U.S. after World War II, as a method for analyzing changing vertical arrangements within subsectors. Definitions of *vertical coordination* include: "all the ways of harmonizing the vertical stages of production and marketing" (Mighell and Jones, 1963), and "the sufficiency of the system of prices and other mechanisms as carriers of information and as incentives and directors of the allocation of resources in a subsector" (Marion, 1986). Coordination refers to both a process (conduct) and a state (performance).

An agricultural *subsector* is an interdependent array of organizations, resources, laws, and institutions involved in producing, processing and distributing an agricultural commodity (Marion, 1986). Shaffer (1968) describes an agricultural subsector as "the vertical set of activities in the production and distribution of a closely related set of

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[2]A complete discussion of exchange relationships would include the role of property rights. Coercion and mutual coercion and their inter-connectedness with the a priori distribution of property rights and residual claimants is discussed in detail in A. Allan Schmid's book: *Property, Power, and Public Choice: An Inquiry Into Law and Economics*. This research accepts property rights as given, something managers must incorporate into their decision making process.

commodities." For our purposes, subsectors encompass the entire range of productive processes and services associated with a specific commodity. That is, those coordinating activities, exchange relationships and stages of production from input suppliers to consumers who purchase food products (see Figure 1.2)

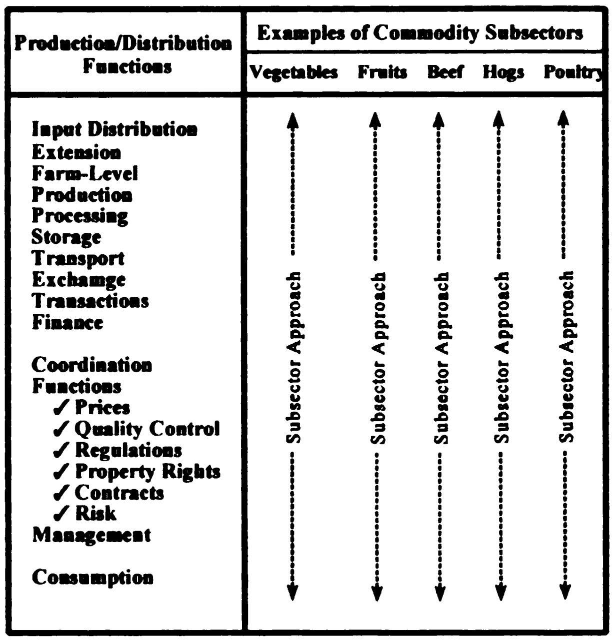

Figure 1.2 The Components of Subsector Analysis

Source: Adapted from Boomgard et al. "Subsector Analysis: Its Nature, Conduct and Potential Contribution to Small Enterprise Development," MSUAID Working Paper no. 26.

A *stage of production* is "any operating process capable of producing a saleable product or service under appropriate circumstances" (Mighell and Jones, 1963). For Williamson, "technologically separable interfaces" are equivalent to stages of production. The main economic question is how to harmonize the various stages of production over time and in a manner that covers the costs of production given: biological lags in production, perishability of products, technical innovations, unforeseen shifts in demand, supply, and human behavior. Table 1.1 describes the various stages of production in the U.S. fruit and vegetable subsectors.

Producers are agents or firms that grow crops or raise livestock which are eventually converted into a final consumer product. An example would be a farmer who grows potatoes. *Commodity assemblers* are agents or firms that purchase products from producers and provide a consolidation and/or marketing function. Michigan potato shippers/brokers act as first handlers when they purchase potatoes from potato growers to be sold to potato processors or retailers. *Processors and further manufacturers* prepare the food products for further processing and/or consumption. McCain Foods acts as an initial processor/further manufacturer when they grade, peel, and form raw potatoes into frozen french fries to be sold to retailers and food service operations, who in turn, offer the product in a frozen or ready-to-eat form to U.S. consumers.

Given the continuing industrialization of agriculture in the U.S., the resulting "new consumer" and "new producer," and the number of available vertical coordination strategies, the selection of the "best" vertical coordination strategy is critical to the survival of individual firms and industries. This research argues that used properly, the strategic management process is an indispensable part of the decision maker's and researcher's tool kit for coping in this changing agri-food system.

Table 1.1 highlights just a few of the possible transaction interfaces that exist within a given subsector. The proposed framework is designed to be applied against specific transaction interfaces within a given product/service value chain. For example,

Table 1.1 Stages of Production in the U.S. Agri-Food System: Fruit and Vegetable Subsector Example

Stage	Description
Input Distribution	This includes the provision of goods and services used in the production of fruits and vegetables. For example, seed, chemicals, and fertilizer.
Fruit and Vegetable Production	Small family operations, averaging only a few acres to large corporate operations farming thousands of acres. Although these producers are found throughout the country, there is a concentration of large operations in the Southwestern U.S.
Commodity Assembly (Shippers/Brokers)	Commodity assemblers are agents or firms that purchase products from producers and provide a consolidation and/or marketing function.
Processing/Further Manufacturing	Processors and further manufacturers prepare the food products for further processing and/or consumption.
Wholesaling and Retailing (Retail and Food service operations)	American consumers spent just less than 50% of their food dollars on food purchased at traditional grocery store establishments in 1997. This percentage is likely to continue declining as people dine away from home more. The locus of power has shifted away from processors to retailers and consumers. Retailer access and control of scanning technology are factors.
Consumption (Consumers)	Some consumers buy based on price, while other demand attributes, not just cheaply priced goods. Consumers' tastes are becoming increasingly diverse. For example, American consumers seek out an ever expanding variety of ethnic foods such as Chinese, Thai, Italian, Mexican, Middle Eastern, etc. As another example, consider the growing number of health conscious Americans who are demanding low calorie, low fat foods.

the transaction interface between fruit/vegetable production and commodity assembly. The value chain concept was pioneered by Michael Porter (1985) and is based on the assumption that a business' basic purpose is to create value for users of its products or services. In a value chain, decision makers divide the activities of their business into sets of separate activities that add value. Their firm is viewed as a chain of value-creating activities starting with procuring raw material or inputs and continuing through design, component production, manufacturing and assembly, distribution, sales, delivery, and support of the ultimate user of its products or services (Pearce and Robinson 1997: p. 176-177).

The next subsection introduces the characteristics of coordination along the vertical coordination continuum, the primary coordinating mechanisms (which relate one vertical coordination strategy to another), and the five separate, but interrelated strategies which comprise the vertical coordination continuum.

1.2.2 Defining the vertical coordination continuum

Vertical coordination can be defined as "the alignment of direction and control across segments of a production/marketing system" (King, 1992). The factors aligned and controlled are price, quantity, quality[3], and terms of exchange (Sporleder, 1992). From a theoretical perspective, the options for achieving vertical coordination have been conceptualized as a continuum running from open markets to complete vertical integration. Others have characterized the continuum as a spectrum of arrangements,

[3]Quality is a multi-faceted variable which implies the process of vertical coordination is not as simple as maximizing a production function.

from loose to tight, from arms-length bargaining to total integration, from spot transactions via standing relations to the internalization of markets (Thorelli, 1986: p. 37). Williamson has established this sense of a continuum generally, while Sporleder (1992), Barkema (1994), Henderson, (1994), Martin, et al., (1993), Galizzi and Venturini, (1997: p. 2), and others have presented this idea in relation to agri-food markets.

Although the idea of a continuum is intuitively appealing, most of the prior theoretical work has focused on the two ends of the continuum, i.e., spot markets and vertical integration, while the middle of the continuum has been largely unexplored in detail, except to posit that various forms of contracting lie along the middle points. Transaction cost analysis' original framework presented the governance question as a discrete choice between market exchange and internal organization, while the current version of the theory explicitly acknowledges that degrees of internal organization can be achieved without ownership or complete vertical integration. Williamson (1991) himself suggested that hybrids could be viewed conceptually as midpoints on a continuum ranging from market exchange to hierarchical integration.

A variety of hybrid mechanisms have been identified in the literature, ranging from formal mechanisms, such as contracts,[4] provisions and equity arrangements[5] (Joskow 1987; Osborn and Baughn 1990), to more informal mechanisms, such as information sharing and joint planning[6] (Noordewier, John, and Nevin 1990, Palay 1984). This middle has also been defined as networks (Thorelli, 1986) or hybrid governance structures

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[4]Identified as specification contracts in this research.

[5]Joint ventures and cooperatives are defined by this research as formal cooperation.

[6]A form of a strategic alliance.

(Williamson, 1975; Powell, 1987; Borys and Jemison, 1989). To help firms decide coordination strategy, much more needs to be known about the vast middle and how it truly is a continuum (Peterson and Wysocki, 1997).

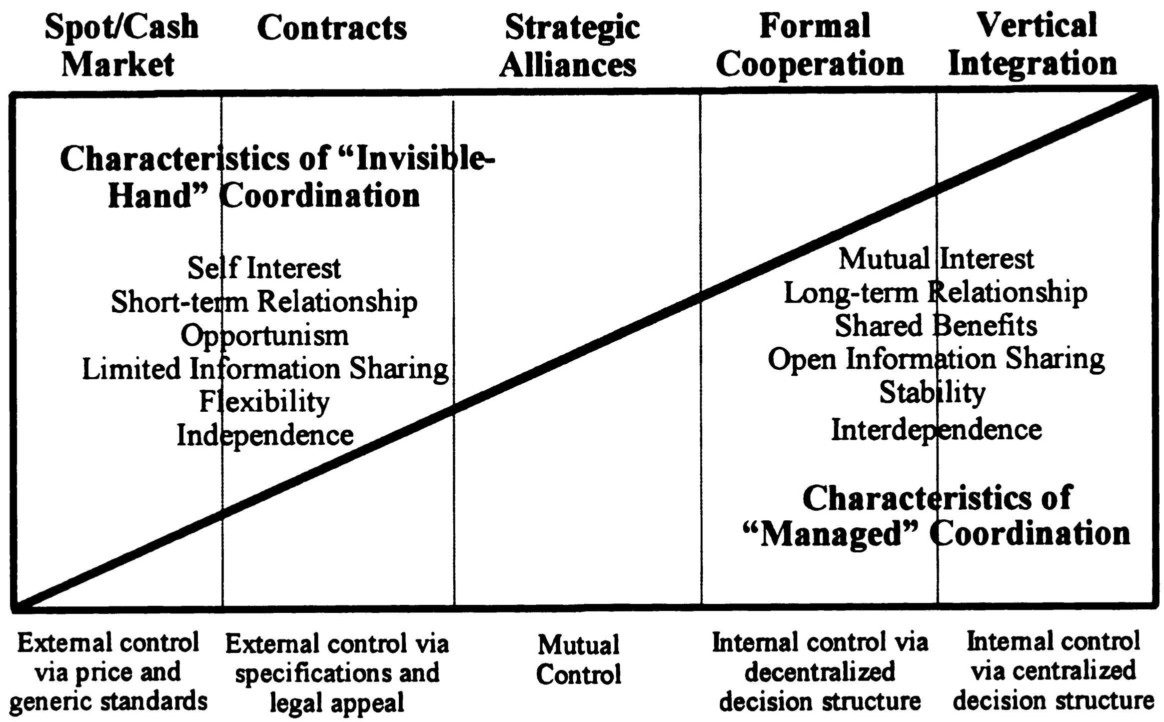
To be fair to the literature, there has been considerable research regarding individual strategies within the continuum. For example, Spekman et al. (1996) conducted an in-depth analysis of many international strategic alliances to better understand the processes of alliance formation and management. Spekman's findings were limited to showing that successful alliances depended on both business and interpersonal relationships, and that the demands of each vary over the lifetime of the alliance. While this type of research is useful, this dissertation calls for research that seeks to understand the uniqueness and interconnectedness between individual strategies and the entire continuum of vertical coordination strategies.

1.2.3 Characteristics of the vertical coordination continuum: "Invisible Hand" versus "Managed" coordination

Figure 1.3 presents the continuum hypothesized for this research. Five major categories of vertical coordination strategy are suggested running, as in past works, from spot markets to vertical integration. At the ends of the continuum, the characteristics of "invisible-hand" coordination and "managed" coordination are respectively listed. The diagonal line in Figure 1.3 represents a mix between the invisible-hand and managed coordination characteristics found in each of the five alternative coordination strategies. The area above the diagonal shows the relative level of invisible-hand characteristics, while the area below the diagonal shows the relative level of managed characteristics.

Figure 1: THE VERTICAL COORDINATION CONTINUUM

Strategic Options for Vertical Coordination



Respective Primary Coordinating Mechanisms

Figure 1.3 The Vertical Coordination Continuum

Source: Peterson and Wysocki Invited Paper, 1997 WCC-72 Conference, Las Vegas, NV

True to Adam Smith (1776), invisible-hand coordination allows individual economic actors to follow their self-interest. Williamson and others have added to Smith's earlier work by allowing individual economic actors to pursue exchange relationships that are short-term, opportunistic (with guile), limited as to information sharing, flexible, and preserving of the actors' independence.

At the other extreme, managed coordination is built upon the mutual interests of the exchange actors who pursue relationships that are long-term, benefit sharing, open as to information flow, stable, and supportive of interdependence. The continuum of Figure 1.3 suggests that, as strategies are considered from left to right, coordination moves from being dominated by invisible-hand characteristics through a changing mix of invisible-hand/managed characteristics to being dominated by managed characteristics.

Vertical coordination strategies are arranged across the continuum such that one would expect to see relatively more invisible-hand characteristics such as self interest, short-term relationships, opportunism, limited information sharing, flexibility, and independence under spot markets and contracts versus strategic alliances, formal cooperation, and vertical integration. One would also expect to see fewer managed characteristics such as mutual interest, long-term relationships, shared benefits, open information sharing, stability, and interdependence under spot markets and contracts versus strategic alliances, formal cooperation, and vertical integration.

1.2.4 Control: the primary coordinating mechanism along the continuum

The primary coordinating mechanism of vertical coordination is the extent or intensity of control exercised for each strategic option as one moves across the continuum from spot markets toward vertical integration (see Figure 1.3).

Control in spot markets

Control over coordination is exercised externally for spot markets and is expressed as price and generic standards for the product or service. The price system is the predicted institutional arrangement for exchange (Mahoney, 1992). Price signals, in turn, link consumers to retailers, retailers to wholesalers, wholesalers to processors, and processors to farmers and ranchers. Prices must mesh closely with grades and standards, rewarding producers with higher prices for higher grade products and penalizing them with lower prices for low grade products (Barkema, 1994).

Control in specification contracting

Intensity of control over coordination increases, but is still largely external when specification contracting is used as a strategic option for vertical coordination. External mechanisms are expressed as third party judgements and detailed contract specifications. Although contracts involve negotiation, goodwill, and legally binding arrangements, ultimate control is based on the threat of third party judgement that may be sought if contract performance is not up to the expectations of the parties involved in the contract.

Control in strategic alliances

Control intensity increases in strategic alliances and is exercised through mutual agreement of the parties involved in the alliances. Strategic alliances are special forms of business linkages. They may be defined as business arrangements in which the organizations involved share risks and benefits emanating from mutual control and the decision-making processes related to mutually identified objectives (Martin et al., 1993). For example, a Michigan seed potato producer has entered a strategic alliance with his three largest customers by setting a verbal price for seed one a year ahead of time. There is no written contract, just a handshake and understanding that buyer and seller are to pay attention to the spot market, but they are more interested in a long term relationship where everyone works together. Strategic alliances represent a transition between control that is external to control that is internal. The analogy of a marriage is appropriate when discussing strategic alliances. The glue that holds strategic alliances together is trust between the parties involved.

Control in formal cooperation

The intensity of control in cooperatives, decentralized corporations, joint ventures, or marketing orders is relatively high and is primarily exercised through internal mechanisms. Characteristics of these internal mechanisms include formalized organizational form, partial equity investment (usually as emotional, sweat, or financial equity), and decentralized decision making. While many cooperatives may appear on the surface to operate under a system of centralized control through the existence of strong management or board of directors, the members have the ultimate say regarding the coordination and strategic direction of the cooperative.

Control in vertical integration

The intensity of control reaches its highest levels under vertical integration. Coordination through vertical integration is accomplished through strong internal mechanisms. Primary control mechanisms of vertical integration include formalized organization, nearly complete equity investment and centralized decision making. These internal mechanisms are governed by the unilateral administrative decisions of managers of the integrated firm and the fiat of bureaucracy through which these decisions are carried out (Blair and Kasserman, 1983).

1.2.4.1 Concluding remarks regarding control along the continuum

Showing that the two end strategies as well as the middle strategies form a continuum requires a primary focus on how the mechanisms for achieving coordination change across the continuum. Only a few attempts have been made to systematically arrange various types of vertical coordination arrangements along a hierarchical scale of control (Henderson, 1994: p. 551). This research posits that external control via price and generic standards, characteristic of spot markets, gives way to internal control via centralized decision structures in vertical integration. That is, the intensity of control increases from spot markets and reaches its peak with vertical integration.

1.2.5 Five distinct but related vertical coordination strategies

The strategic options or strategies comprising the vertical coordination continuum as defined by this research are now presented. Defining features of each strategic option are highlighted, and where appropriate, examples are given to reinforce the concepts.

Albert Hirschman (1970), in his book *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States* offers a useful taxonomy for explaining the mechanisms which are used to correct the repairable lapses of economic actors:

> "Under any economic, social, or political system, individuals, business firms, and organizations in general are subject to general lapses from efficient, rational, law-abiding, virtuous, or otherwise functional behavior. No matter how well a society's basic institutions are devised, failures of some actors to live up to the behavior which is expected of them are bound to occur, if only for all kinds of accidental reasons. Each society learns to live with a certain amount of dysfunctional or misbehavior; but lest the misbehavior feed on itself and lead to general decay, society must be able to marshal from within itself forces which will make as many of the faltering actors as possible revert, to the behavior required for its proper functioning." p. 1

Hirschman states mechanisms which make as many of the actors as possible revert to the behavior required can be found applicable not only to economic operators such as business forms, but to a variety of non economic organizations and situations. These mechanisms are labeled by Hirschman as *exit, voice,* and, loyalty, are also useful for classifying the nature of the exchange relationship taking place at each vertical coordination strategy. The concepts of exit, voice and loyalty are now briefly described:

> "Exit for Hirschman is defined as when some customers stop buying the firm's products or some members leave the organization... When the firm's customers or the organization's members express their dissatisfaction directly to management or to some authority to which management is subordinate or through general protest addressed to anyone who cares to listen: this is the voice option... Loyalty involves the decision to stick with a deteriorating firm or organization and this decision is in turn based on: (1) an evaluation of the chances of getting the firm or organization back on track, through ones own action or through that of others, and (2) a judgement that it is worthwhile, for a variety of reasons, to trade the certainty of an alternative which is available here and now against the chances of improving the current situation." p. 4

Exit, voice, and loyalty will now be juxtaposed against the individual strategies of the vertical coordination continuum.

1.2.5.1 Spot markets

In spot markets, coordination between two actors in an economic exchange is exclusively or nearly exclusively achieved through reliance on a control mechanism external to the actors' relationship. Price and broadly accepted performance standards determine the nature of exchange. In pure competition, neither parties can influence price nor the generic standards, and both must stick to them if effective exchange is to occur.

In extreme cases of less than pure competition such as in a monopoly situation, one actor can have a major influence over the establishment of the coordinating conditions. To the actor with this market power, it seems that some level of control is internal to the exchange relationship. The powerful actor can specify some terms of exchange. However, in spot markets, the weaker actor retains the right to walk away from the relationship. Hirschman would describe the relationships within spot markets as exhibiting exit, no voice, and no loyalty. The availability of substitute products puts another type of external limit on the exchange. The true nature of spot markets arises from this notion that the controlling mechanism of coordination is entirely or nearly entirely external to the exchange relationship.

1.2.5.2 Specification Contracts

The next step along the continuum is suggested to be specification contracting, the legally enforceable establishment of specific and detailed conditions of exchange. With contracts[7], the mechanism for coordination has now become partly internal to the exchange relationship. The actors must agree among themselves on the specifications of the contract. However, the relationship is still governed largely by forces external to the relationship in the sense that once the specifications have been agreed to, the ultimate enforcement of performance is delegated to a third, external party represented by the legal system. What begins as negotiated terms among the actors internal to an exchange becomes an external standard that the actors must stick to, or face an external enforcement power. Given the costs of appealing to this external power, the threat of such appeal may be more important to the conduct of exchange than the reality of it.

Consider a green bean grower who enters a specification (marketing) contract with a local processor. The typical contract requires the seed to be provided by the processor. It is quite possible that the processor will also suggest the parameters around other inputs such as the fertilizer and pesticides to be used. There is generally some room for negotiation regarding growing practices and levels of inputs used, although any application of these inputs is likely to need prior approval of the processor. Finally, a base contract price is set for the harvested green bean crop before any planting is done. The final return to the grower is based on various yield and quality incentives less variable costs associated with the growing of the bean crop.

Hirschman would label the relationship taking place under specification contracting as exhibiting less freedom to exit, but the contractee has gained some voice. There is no

[7]It should be noted, that this research considers various risk management tools such as forward contracting, hedging, and the futures markets to be simply "tools" used in carrying out spot market relationships.

real loyalty by the grower or the processor, other than what is coerced by the external nature of the relationship.

1.2.5.3 Strategic alliances

A strategic alliance, the third portion of the continuum, may be defined as an exchange relationship in which the firms involved share risks and benefits emanating from mutually identified objectives[8]. For an exchange relationship to be a strategic alliance, it must exhibit the following three mutuality characteristics: objective identification, controlling decision making processes (Martin et al., 1993; Galizzi and Venturini, 1997: p. 6) and, sharing risks and benefits. For example, Wal-Mart needs Proctor and Gamble's brands and Proctor and Gamble needs Wal-Mart's access to customers. Following this definition, the coordinating mechanism in a strategic alliance is the mutual agreement of the parties involved in the alliance. In other words, coordination arises from mutual control. In a significant way, strategic alliances represent a middle ground between external and internal control over coordination. The analogy of a marriage is appropriate when discussing strategic alliances. The partners agree to work closely together and thus must find some means to resolve internal differences and concerns. Yet, both parties retain their separate, external identity. The breadth of the agreement is such that mere appeal to a third party judge is not practical across most of the agreement (except in the unfortunate case of a dissolution), and yet a formal joint management structure is not present to allow for strong internal control. Unlike a marriage, exit costs are relatively

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[8]A Booz, Allen, and Hamilton study reported that the number of strategic alliances in the U.S. has been surging to more than 20,000 new alliances between 1987 and 1992 (Spekman, et al., 1996). The Booz, Allen, and Hamilton report also indicated that upwards of 60 percent of all alliances fail.

low in a strategic alliance. A breach of expectations by either party results in termination of the alliance, typically without legal recourse or third party enforcement (Sporleder, 1994: p. 536). The coordinating mechanism must be based on mutual control arising from mutual interest.

With strategic alliances, the continuum crosses a significant dividing line between coordination mechanisms that rely on external control (spot markets and contracts) and mechanisms that rely on internal control (formal cooperation and vertical integration). The enforcement mechanisms from this point on in the continuum are established internal to the exchange relationship. However, vertical control provided by a strategic alliance is weak and malleable relative to other arrangements (Sporleder, 1994: p. 536).

Before discussing these internal mechanisms further, an additional observation is in order. Many strategic alliances do have some form of contract as part of the alliance. For example, the Michigan Livestock Exchange (MLE) has an exclusive supplier contract as part of its alliance with Thorn Apply Valley, a meat processor. Yet this contract is only one part of the alliance's foundation. The two organizations hope to develop joint marketing strategies that will improve the ability of both organizations to prosper in the changing meat industry. If the alliances were merely limited to the nature of a legal supplier contract, neither firm would achieve the broader working relationship that each wants for long-term viability. Therefore, the existence of a contract in an exchange relationship does not necessarily mean that the relationship lies on the specification contract portion of the continuum. The real question is what is the *primary* mechanism of coordination. In the MLE-Thorn Apple Valley example, the operative mechanism is not the legal agreement itself, but rather mutual control with a fallback reliance on a contract as a minimum standard for the exchange relationship.

For Hirschman, strategic alliances create less freedom to exit than in a spot market relationship. However, there is even more voice than was present in specification contracting. Loyalty, based on trust can be very high if there are mutually identifiable objectives between the parties of the strategic alliance.

1.2.5.4 Formal cooperative arrangements

The fourth position along the continuum, formal cooperation, has been least explicitly defined by prior authors. In this research, formal cooperation is designed to include a seemingly odd mixture of organizational forms such as joint ventures, partial ownership relationships, clans, and other organizational forms that involve some level of equity commitment (money, sweat, or emotional) between the actors in an exchange relationship. The distinguishing feature between formal cooperation and a strategic alliance is the presence of a formal organization that has an identity distinct from the exchange actors, one designed to be their joint agent in the conduct of a cooperative exchange. By definition, an agency relationship (with its associated principal-agent issues) is formally introduced when formal cooperative relationships are undertaken.

For the first time along the continuum, there is a formal organizational structure that can allow for some form of true internal control. Policies and procedures can be formally put in place for the conduct of exchange between the parties. An equity commitment makes defining the decision rights and responsibilities more clear cut than in the case of a strategic alliance. Agricultural cooperatives clearly lie at this point on the continuum as do joint ventures and the keiretsus of Japan. The key to understanding this coordination mechanism is that, although control can now be accomplished internally, the control is *decentralized* between the ownership parties and the ownership parties still maintain a separate identity that allows them to walk away from the exchange if they so choose. This ability to walk away, however, has been dramatically reduced by the presence of the new independent identity and the equity investment in it. Many members also derive considerable satisfaction out of belonging to a group such as a cooperative which also makes it difficult to walk away from the cooperative.

Under formal cooperation, exit is still possible, but likely to be costly. The nature of the equity arrangements creates strong voice among the owner/members. The nature of the equity arrangement is probably responsible for the increased levels of loyalty exhibited under this vertical coordination arrangement.

1.2.5.5 Vertical integration

The final strategy of the continuum is vertical integration. However, if the above arguments regarding control are taken to their logical conclusion, vertical integration is not so much defined by financial ownership as it defined by *centralized control*. Although a corporation operating at multiple levels in a production/marketing chain may have single financial ownership, it need not constitute a case of vertical integration if the business units of that corporation are allowed to operate autonomously (i.e., in decentralized fashion). Such a corporation operates as a form of formal cooperation and not vertical integration. Vertical integration in this research is a mechanism that relies upon centralized control to achieve coordination. This is what economists have most often meant by true hierarchy--a command and control system within a single organization.

The difficulty of the observed evolution of firms is that single financial ownership no longer assures singularity of organization as the above example of a decentralized firm points out. Vertical integration requires a centralized decision making structure that tightly controls the operations of its diverse business units. Just as single ownership across various levels of a value chain may not result in vertical integration, multiple ownership across various levels of a value chain does not prevent vertical integration from occurring. For example, does Tyson Foods operate on the specifications contract portion of the continuum, or does it exercise sufficient centralized control so that it operates a truly vertically integrated system with chicken producers maintaining separate ownership identity in name only? Tyson coordinates with their farmers through specific production contracts. Tyson or the farmer has the option of refusing to renew the contract. If Tyson owned the farming stage, this option would no longer be available to the farmer raising the chickens.

Though Tyson does not own the farming stage of chicken production (there is separate ownership regarding production, processing, and marketing of chickens), these Tyson farmers have limited options regarding chicken production. Based on the limited alternatives of the farmers and the extensive control Tyson has over the entire chicken production process, separate ownership and control takes place in name only. Tyson can be said to be vertically integrated even without single ownership.

Under vertical integration as defined in this research, exit is drastically limited. For example, if a manager of a division within a vertically integrated firm does not agree with the strategic direction of the parent company, he or she can try to change the entire company's strategic direction, put up with the situation, or find other employment. The manager cannot easily change the strategic direction of the division (a form of exit), if this change is opposing the strategic direction of the entire company, and company leadership does not want to change strategic direction.

Voice may be exercised by either party (in the case of Tyson and their producers), but the control belongs to the integrator. In this sense Hirschman would say voice and loyalty are absolute under vertical integration.

1.2.5.6 The fuzziness of the vertical coordination continuum

Given the seemingly odd mixture of organizational forms found under the heading of formal cooperation, a few words about the "fuzziness" of the continuum and the nature of joint ventures and clans are in order.

Mahoney and Martin each specify joint ventures as a form of vertical coordination strategy. For Mahoney, a joint venture is an equity agreement by which a separate entity is created. Martin presents a joint venture as a governance form based on an equity agreement created to complete a one-time project. In this paper, a joint venture is considered on the border between strategic alliances and formal cooperation because joint ventures usually require some kind of mutual consent, limited equity investment and a fair amount of decentralized control.

Clans are composed of informal social systems based on subtle, but widespread local values which influence individual behavior. Socialization processes characteristic of groups such as physicians or nurses who occupy different organizations but with similar values. These groupings are often called professions. When the socialization process refers to all of the citizens of a political unit, we call it a culture. When it refers to the properties of a unique organization, it is called a clan (Ouchi, 1979: p. 837). Within clans, control arises out of relationships emphasizing trust and human dignity. Both Mahoney (1992) and Ouchi (1979) describe clan relationships taking placing within an organization. However, the control exercised within a firm organized as a clan is very different from a firm that uses control via a fiat under vertical integration. It is this cooperative nature of control that allows clans to be placed within the formal cooperation strategy, near the border of formal cooperation and vertical integration strategies of the continuum.

Although the vertical coordination continuum has been presented as consisting of five distinct strategic options, strategies such as joint ventures and clans point to the "fuzzy" versus distinct boundaries of the strategies found along the vertical coordination continuum. The fuzziness of the vertical coordination continuum ultimately needs to be understood. However, the theory-building nature of this research will concentrate on the vertical coordination continuum as if it were five distinct strategies. This is a necessary simplification of reality to build a manageable framework.

1.2.5.7 Concluding remarks regarding the vertical coordination continuum

The above discussion has attempted to establish that the proposed continuum as a continuum in more than name only. The coordinating mechanisms move from low intensity (external as in spot markets) to high intensity (internal as in vertical integration) while passing through several transitional stages of mixed form (specifications contracts, strategic alliances, and formal cooperation). Although ownership is correlated with this transformation, it is not (as historically argued) synonymous with it.

The strategic options for vertical coordination presented in Figure 1.3 are similar to vertical coordination taxonomies as presented by Mahoney (1992), Martin et al. (1993), and Barkema (1994). This research consolidates the long-term and inside contracts of Mahoney and Martin, and the market specification, production management, and resource providing contracts of Barkema into the general category called specification contracts. Relational contracts, as presented by Barkema and Mahoney would be considered forms of strategic alliances in the vertical coordination continuum as presented in this research. Joint agreements are considered to exhibit characteristics of strategic alliances and some form of cooperative effort in this research.

Mahoney, Martin, Barkema, and this research define spot markets as a coordination strategy that relies on the traditional economic concept of firms as price takers, operating in a system where price acts as the main coordinating mechanism. This research treats clans as a type of formal cooperation strategy employed within an organization that exhibits characteristics of vertical integration. While, marketing orders are placed under formal cooperation within the continuum. In some respects they do not fit neatly, given that they are usually a form of horizontal integration. However, most marketing orders mandate participation from different vertical stages of the food system. It is this coordination of actors in various stages and the emotional equity[9] required that lead to placing marketing orders as a type of formal cooperation strategy. For example,

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[9]Commodity marketing orders require the agreement of a majority (e.g., a two-thirds majority) of the producers before the USDA will sanction the marketing order.

the Michigan cherry marketing order involves producers of cherries and mandates that cherry processors collect the assessment.

1.3 Concluding Remarks Regarding Statement of the Research Problem and the Vertical Coordination Continuum

Fundamental changes are underway in the U.S. agri-food system, changes that are altering traditional marketing relationships. Parts of the food system are becoming tightly integrated, such as, the poultry and increasingly the pork subsectors. The tightening of vertical linkages has been characterized by movement from open markets to various forms of managed coordination, e.g., contracting, strategic alliances, and single ownership of multiple market stages.

To date, research about these changing modes of coordination might be largely focused on either (1) developing a better understanding of the characteristics and motivations of an individual mode of coordination, or (2) understanding the broad differences between external (market) and internal (contract/ownership) approaches to vertical coordination. While these efforts have been necessary and valuable, this research will take a different direction. Given the increasing variety of vertical coordination strategies available to agri-food firms, how does a particular firm decide which strategy to use?

Empirically, it can be observed that many variations of vertical coordination strategy have evolved, both in agri-food markets and in other industrial markets, including joint ventures, keiretsus, virtual corporations, licensing agreements, production specification contracts, etc. On the one hand, if each of these strategies is distinct and no taxonomy exists to show how these various strategies are interrelated, then firm-level decision making becomes an immensely complex task of assessing, option by option, which strategy may be feasible and appropriate for a particular firm in a particular market situation. On the other hand, if the strategies are interrelated and form a true continuum of options, then understanding the continuum and its characteristics helps simplify the decision process. A given firm can assess its current and/or desired place on the continuum and then select an appropriately limited number of coordination strategies for further analysis and choice.

This research argues that a continuum does exist and decision makers should consider a limited number of factors in their choice of vertical coordination strategy. The rest of the dissertation is divided into the following chapters: (1) Chapter 2, theoretical foundation for the proposed framework, and development of the framework itself (2) Chapter 3, methodology used in this research, (3) Chapter 4, findings of the information gathered through industry analysis, (5) Chapter 5, empirical findings of the information gathered, based on quantitative analysis of the interview process, and Chapter 6, conclusions and implications for further study.

CHAPTER 2
THEORETICAL CONTEXT REGARDING THE DECISION PROCESS FOR ALTERING A VERTICAL COORDINATION STRATEGY ALONG THE CONTINUUM

Having defined the nature and characteristics of the coordination continuum in the previous chapter, the next logical question is where should a particular firm place itself along the continuum. Potentially, a firm must make this strategic decision for every vertical (forward and backward) exchange relationship it undertakes while doing business. Finding effective and efficient means to make these decisions seems of obvious importance.

This chapter presents the framework used in this research that models the decision process for altering a vertical coordination strategy. Choice of vertical coordination strategy is best modeled as a fluid (versus static) process. The proposed framework seeks to extend the theoretical advancements made by earlier scholars in economics, business, sociology, strategic management, and organization science.

The decision process for altering a vertical coordination strategy is composed of a catalyst for beginning the search process and four distinct decision nodes that lead to the adoption of an alternate vertical coordination strategy. The catalyst for beginning the search can be stated as: is a coordination error costly? The four decision nodes can be represented as four key questions: (1) does an alternative reduce the costliness of a coordination error?, (2) is an alternative programmable or can an alternative that is programmable be conceived?, (3) is an alternative implementable or can the constraints that are preventing implementation be overcome?, and (4) is the risk/return tradeoff of the alternative strategy acceptable or can the risk/return tradeoff of an alternative strategy be improved to an acceptable level?

Once an alternative vertical coordination strategy has been adopted, the framework incorporates a feedback loop that allows for reevaluation of the newly adopted vertical coordination strategy resulting in the decision process cycling again. Terms and concepts relating to the decision nodes will be defined in their entirety, when the proposed framework is presented in detail, later in this chapter.

The rest of the chapter is divided into the following sections: (1) the nature of firm-level decision making along the continuum, including the basic tenants of transaction cost analysis, agency theory, resource-based theory of the firm, and path dependence, (2) a recent strategic management framework for predicting organizational form along the vertical coordination continuum, (3) an intuitive and detailed explanation of the proposed framework regarding the decision process for altering a vertical coordination strategy, and (4) concluding remarks.

2.1 The Nature of Firm-Level Decision Making Along the Continuum

This research postulates that choice of vertical coordination strategy is a dynamic process that combines the nature of the transaction, feasibility conditions, path dependence, and behavioral characteristics unique to the decision maker. The contribution of past theoretical works on organizational form (issues of governance) only partially explain the choice of vertical coordination strategy because they focus almost exclusively on the nature of the transaction (see Mahoney 1992, and Martin et al. 1993). The Mahoney framework (to be discussed shortly) provides a solid theoretical base for how the nature of the transaction affects the choice of vertical coordination strategy, but does not directly address feasibility conditions, path dependence, or behavioral characteristics unique to individual decision makers.

Competing theories of the firm have been developed in economics, strategic management, and organization science. Until recently, most of these research streams have focused on developing a theory of the firm utilizing standalone theories such as transaction cost theory, agency theory, resource-based theory, and knowledge-based views. Pioneering work in each of these areas is attributed to the following scholars: Williamson for transactions cost theory, Alchain and Demsetz and Eisenhardt for positive agency theory, Jensen and Meckling for firms as a nexus of contracts, Rumelt and Teece for resource-based theory, and Polyani, Nelson and Winters for knowledge-based view of the firm.

Scholars are calling for a melding of research streams regarding choice of organizational form including: Mahoney's (1992) framework for predicting the organizational form of vertical control, Hirsch's, et al. (1987) paper on sociology's growing reliance on economics, and Eisenhardt's (1989: p. 71) call to use agency theory with complementary theories. As guest editors of the 1996 Winter Special Issue of the Strategic Management Journal, Spender and Grant (1996) recall a particular paradigm shift within the strategic management field:

> "Increasing criticism of the excessive abstraction and quantification in management education also played a role [in changing organizational theory]. The underlying paradigm of management research came under threat, reflecting an academy-wide shift away from the pursuit of a natural science type of organizational theorizing

> toward a richer and more complex framework that included rather than excluded people and their idiosyncracies, culture and history - and their knowledge and skills." p. 6

This research seeks to combine the insights of transaction cost analysis, positive agency theory, the resource-based theory of the firm, and the idiosyncracies, culture and history of people to create a more robust model of the decision process for altering a vertical coordination decision. The basic tenants of transaction cost analysis, agency theory, resource-based theories of the firm, and path dependence are presented next. This will be followed by a presentation of the framework regarding the proposed decision process for altering a vertical coordination strategy.

2.1.1 Transaction cost analysis

Transaction cost analysis belongs to the "New Institutional Economics" paradigm, which may over time, lead to a rethinking of traditional neoclassical economics. While neoclassical economics has largely ignored the idiosyncracies of the firm, relegating the firm to a "black box" described as a production function (Barney 1990 and Hesterly 1996), transaction cost analysis explicitly views the firm as a governance structure. One of Coase's (1937) initial propositions was that firms and markets are alternative governance structures that differ in their transaction costs. Specifically, Coase proposed that under certain conditions, the costs of conducting economic exchange in a market may exceed the costs of organizing the exchange within a firm. In this context, transaction costs are the "costs of running the system" and include such ex ante costs as drafting and negotiating contracts and such ex post costs as monitoring and enforcing agreements

(Rindfleisch and Heide 1997). Transaction cost analysis may explain, in part, why traditionally, most agricultural markets were organized as spot markets.

The role of the government[10] cannot be overlooked as having a major influence on promoting spot market forms of vertical coordination within traditional agricultural markets. The governments established and enforced grades and standards and market information systems. In essence, this governmental intervention reduced the transactions costs associated with the spot market as a vertical coordination strategy. Today we observe a wide range of vertical coordination strategies including spot markets, specification contracts, strategic alliances, formal cooperation, and vertical integration.

According to transaction cost analysis (Williamson 1981), one must believe a priori that the decision makers are better off choosing the spot market verses other forms of vertical coordination. Without transaction costs, the spot market is likely to be the most efficient vertical coordination strategy. Increased efficiency comes from avoiding some costs of bureaucratic governance associated with non-spot market vertical coordination strategies such as vertical integration. Transaction cost analysis treats market contracting as more efficient a priori, than alternative forms of vertical coordination such as vertical integration based on the benefits of competition (Williamson 1975; 1981; 1996). Williamson's explanation provides insight into why so many agricultural commodities have been dominated by spot market coordination traditionally.

Williamson (1975; 1985; 1996) has added to Coase's general argument by identifying the types of exchanges that are more appropriately conducted within firm

[10]Government and institutions, in general are part of what this research calls institutional acceptability, which is described in detail in an upcoming section of this chapter.

boundaries than through the market. He also has suggested that transaction costs include both the direct costs of managing relationships and the possible opportunity costs of making inferior governance decisions, both of which are the building blocks for what this research identifies as the"costliness of a coordination error." Williamson's framework rests on the interaction between two main assumptions of human behavior (i.e., bounded rationality and opportunism) and two key dimensions of transactions (i.e., asset specificity[11] and uncertainty). The behavioral assumptions and transaction dimensions of transaction cost analysis are interwoven throughout the framework used in this research. A brief description of the interaction between these behavioral assumptions and transactional dimensions is warranted.

Bounded rationality is the assumption that decision makers have constraints on their cognitive capabilities and limits on their rationality. Although decision makers often intend to act rationally, this intention may be hindered by their limited information processing and communication ability (Simon 1957). Bounded rationality may prohibit individuals from possessing identical stocks of knowledge. This in turn implies that bounded rationality has a role to play in the proposed framework. The effects of bounded rationality will be discussed in an upcoming section.

According to transaction cost analysis, these limited cognitive capabilities become problematic in uncertain environments, in that (1) the circumstances surrounding an exchange cannot be specified ex ante in what Rindfleisch and Heide (1997) label as

[11]This chapter introduces a number of terms and concepts that require definition. Whenever possible, terms and concepts are defined when they are first presented. However, a few concepts such as asset specificity, nonseparability, and task programmability are introduced early on to the reader, but not explicitly defined until later in the chapter, when the proposed framework is presented.

environmental uncertainty, and (2) performance cannot be easily verified ex post and is defined as behavioral uncertainty by Rindfleisch and Heide.

The primary consequence of environmental uncertainty is an adaptation problem, that is, difficulties with modifying agreements to changing circumstances. For example, an agricultural manufacturing firm that, because of the threat of competitive entry, must modify the design of its product also may need to modify the design of the purchased components that constitute the end product. Unless a comprehensive contract can be written with its supplier, which specifies in advance the required component designs and the associated terms of trade, the manufacturer may need to assume the considerable transaction costs associated with ongoing renegotiations.

The effect of behavioral uncertainty is a performance evaluation problem, that is, difficulties in verifying whether compliance with established agreements has occurred. For example, an agricultural chemical manufacturer may have difficulty finding out whether a distributor is giving customers necessary pre-sales services. Alternatively, even if the relevant aspects of a distributor's operations can be measured, the information gathering and processing costs incurred by the manufacturer may be substantial.

Further compounding the effects of behavioral uncertainty is opportunism as described by Williamson. Opportunism is the assumption that, given the chance, decision makers may unscrupulously seek to serve their self-interests, and that it is difficult to know a priori who is trustworthy and who is not (Barney 1991). Williamson (1985: p. 47) defines opportunism as "self-interest seeking with guile," and suggests that it includes such behaviors as lying and cheating, and more subtle forms of deceit, such as violating agreements. Opportunism poses a problem to the extent that a relationship is supported by specific assets whose values are limited outside the primary relationship. Take the agricultural chemical manufacturer who invests in training a distributor only subsequently to have difficulty replacing the distributor with a new one. The incumbent distributor can exploit the situation opportunistically by demanding various kinds of concessions from the manufacturer. Essentially, the effect of specific assets is to create a safeguarding problem, because market competition no longer serves as a restraint on opportunism.

The complete transaction cost analysis framework also includes risk neutrality as a third behavioral assumption and transaction frequency as a fourth transactional dimension. Both constructs are specified by Williamson (1975, 1985) but have received limited attention in the transaction cost analysis literature according to Rindfleisch and Heide (1997). Chiles and McMackin (1996) provide a theoretical discussion of the validity of transaction cost analysis' assumption of risk neutrality, but the researcher is unaware of any empirical investigations of this assumption.

To date, only a few transaction cost analysis studies have explicitly addressed transaction frequency. According to Williamson (1985: p. 60), higher levels of transaction frequency provide an incentive for firms to employ hierarchical governance, because "the cost of specialized governance structures will be easier to recover for large transactions of a recurring kind." Mahoney (1992) argues that predicting the organizational form of vertical control does not consider transaction frequency critical for the following reasons:

> "First, as Williamson (1985) notes, when asset specificity is low, frequency does not influence organizational form. Second, when asset specificity is high, both occasional transactions and recurrent transactions may require unified governance. While frequency does influence the choice of governance structure in the case of 'intermediate' asset specificity, such refined predictions are not attempted here." p. 571

Based on the strength of Mahoney's argument, the proposed framework of this research does not consider transaction frequency crucial for determining organizational form.

2.1.1.1 Concluding remarks regarding transaction cost analysis

Rindfleisch and Heide (1997) eloquently summarize the logic of transaction cost analysis as the interaction of adaptation, performance evaluation, and the safeguarding of costs:

> "The basic premise of transaction cost analysis is that if adaptation, performance evaluation, and safeguarding costs [*necessitated by asset specificity in this research*] are absent or low, economic actors will favor market governance. If these costs are high enough to exceed the production cost advantages of the market, firms will favor internal organization. The logic behind this argument is based on certain a priori assumptions about the properties of internal organization and its ability to minimize transaction costs. Three specific aspects of organizations are relevant in this respect. First, organizations have more powerful control and monitoring mechanisms available than do markets because of their ability to measure and reward behavior as well as output (Eisenhardt 1985; Oliver and Anderson 1987). As a result, the firm's ability to detect opportunism and facilitate adaptation is enhanced. Second, organizations are able to provide rewards that are long term in nature, such as promotion opportunities. The effect of such rewards is to reduce the payoff from opportunistic behavior. Third, Williamson (1975) acknowledges the possible effects of the organizational atmosphere, in which organizational culture and socialization processes may create convergent goals between parties and reduce opportunism ex ante." p 33

In summary, transaction cost analysis is considered one of the key building blocks of this research and is applied explicitly to the section of the proposed framework which analyzes whether or not alternative coordination errors are costly.

2.1.2 Agency theory

During the 1960's and early 1970's, economists explored risk sharing among individuals or groups (Arrow 1971; Wilson 1968). Initially, the literature described the risk-sharing problem as one that arises when cooperating parties have different attitudes toward risk. Agency theory broadened this risk-sharing literature to include the so-called agency problem that occurs when cooperating parties have different goals and divisions of labor (Jensen and Meckling 1976; Ross 1973). Specifically, agency theory is directed at the agency relationship where one party (the principal) delegates work to another (the agent), who does that work. Agency theory attempts to describe this relationship using the metaphor of a contract (Eisenhardt 1989: p. 58).

Many attempts have been made to integrate economics and organizational approaches to the theory of the firm which have included agency theory (Cyert and March 1963). Here principal-agent relationships are used to explain why some organizational forms may dominate others. The agency theory perspective emphasizes information asymmetry issues. A significant aspect of information asymmetry in organizations is the problem of ascertaining and rewarding individual effort in team production (Jones 1984).

The agency problem arises when the desires or goals of the principal and the agent conflict and when it is difficult or expensive for the principal to verify what the agent is actually doing (Eisenhardt 1989: p. 58). The problem here is that the principal cannot verify that the agent has behaved appropriately. A second problem of risk sharing arises when the principal and agent have different attitudes toward risk. The problem here is that the principal and the agent may prefer different actions because of different risk preferences. The key idea of agency theory is that principal-agent relationships should reflect efficient organization of information and risk-bearing costs.

Agency theory shares many similarities with transaction cost analysis. Mahoney (1992) asserts that positivistic agency costs are in fact a subset of transactions costs. The similarities between agency theory and transaction cost analysis include: (1) the shared assumptions of self-interest and bounded rationality, (2) hierarchies of transaction cost analysis roughly correspond to behavior-based contracts of agency theory, and (3) markets of transaction cost analysis compare with outcome-based contracts of agency theory.

Agency theory and transaction cost analysis differ in that transaction cost analysis is concerned with organizational boundaries, whereas in agency theory the contract between cooperating parties, despite the boundary is highlighted. The major difference between agency theory and transaction cost analysis is that each theory has its own set of independent variables. In transaction cost analysis these are asset specificity and small numbers bargaining (Eisenhardt 1989: p. 64). In agency theory these include risk attitudes of the principal and agent, outcome uncertainty, and information systems.

2.1.2.1 Principal-agent and positivistic: two paradigms of agency theory

Agency theory has developed along two lines: principal-agent and positivist (Jensen 1983). The two streams have the same unit of analysis: the contract between the principal and the agent. They also share common assumptions about people, organizations, and information. However, they differ in their mathematical rigor, dependent variable and style. Principal-agent research is concerned with a general theory of the principal-agent relationship. The principal-agent paradigm involves careful specification of assumptions, which are followed by logical deduction and mathematical proof.

Positivistic agency theory[12] research focuses on identifying situations in which the principal and agent are likely to have conflicting goals and then describing the governance mechanisms that limit the agent's self-serving behavior. From a theoretical perspective, the positivist stream has been most concerned with describing the governance mechanisms that solve the agency problem (Eisenhardt 1989: p. 59-60). Since this research is concerned with identifying and understanding the decision process for altering a vertical coordination strategy, it borrows more heavily from the positivist agency paradigm than the principal-agent paradigm. For example, consider the seed potato grower who is selling his potatoes on the spot market to buyers. The buyer has a need to know about the quality of seed he or she is purchasing, while the seed potato producer may have incentives to provide less than full disclosure regarding the quality of the seed potatoes. Positivistic agency theory would identify specifications contracts, as one mechanism which could limit the seed potato producer's self-serving behavior.

2.1.3 Resource-based theory of the firm

Resource-based theory generally addresses performance differences between firms using asymmetries in knowledge and associated competencies or capabilities (Prahalad and Hamel 1990; Winter 1995; Collis 1991). The resource-based theory of the firm is less of a theory of firm structure and behavior and more of an attempt to explain and predict why

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[12]The use of "positivistic" is unfortunate in that it is defined differently than the concept of positivistic knowledge in Chapter 3. Positivistic knowledge is derived from theory. Positivism is a scientific method of obtaining knowledge that is objective and verifiable (Titus 1974). It is learned through deduction and is abstract in that the detail and noise of context are filtered and reduced in search of an underlying cause and effect. The assumption behind the positivistic paradigm is that there is an objective truth existing in the world which can be revealed through the scientific method where the focus is on measuring relationships between variables systematically and statistically.

some firms are able to establish positions of sustainable competitive advantage, and in so doing, earn superior returns (Grant 1996; Lippman and Rumelt 1982). The resource-based view perceives the firm as a unique bundle of idiosyncratic resources and capabilities where the primary task of management is to maximize value through the optimal deployment of existing resources and capabilities, while developing the firm's resource base for the future.

A recent development out of resource-based theory has been the promotion of a related line of reasoning, treating knowledge as a resource. This line of reasoning focuses upon knowledge as the most strategically important of a firm's resources, and as such, is an outgrowth of the resource-based theory (Spender and Grant 1996; Grant 1996; Conner and Prahalad 1996). The role of knowledge is used to: (1) explain the existence of the firm as an institution for the organization of production, (2) explore the nature of coordination within the firm, (3) focus upon the implications of the knowledge-based view for hierarchy and the location of decision-making authority, and (4) determine the boundaries of the firm (Grant 1996).

The central theme emerging in the strategic management resource-based literature is that privately held knowledge is a basic source of advantage in competition, and as such, is part of the resource-based theory of the firm. As Kogut and Zander (1192) comment:

> "The theoretical challenge is to understand the knowledge of a firm as leading to a set of capabilities that enhance the chances for growth and survival." p. 394

A resource-based theory of the firm thus entails a knowledge-based perspective (Conner and Prahalad 1996). This research treats the knowledge acquired by decision makers and their organizations as a resource that leads to possible sustained stand-alone competitive advantage. Resource-based theory may also help explain if an alternative vertical coordination strategy is implementable or not, especially as a firm's resources affect coordination competence. Therefore, in this research, knowledge is considered a special case of the resource-based theory of the firm.

2.1.4 Path dependence

The concept of path dependence provides a valuable insight into the choice of vertical coordination strategy. A path-dependent sequence of economic changes is one where significant influences upon the eventual outcome can be exerted by temporally remote events, including occurrences dominated by chance elements rather than systematic forces (David 1988: p. 332). The success of alternating current over direct, and the survival of the gas engine over steam engine motor cars have been used to illustrate the peculiar fact that incremental changes in technology, once begun on a particular track, may lead one technological solution to win out over another, even when ultimately, this technological path may be less efficient than the abandoned alternative would have been (North 1990: p. 93).

Paul Krugman (1994) describes path dependence in the context of explaining how the U.S. economy and economic policy has evolved over time:

> "For example, where do you live if you work in the film industry? Probably in Los Angeles. Why? Because the other film industry people you need to work with are there. But they are there because they need to be near people like you.... What does this have to do with economic policy? Maybe quite a lot. What conservatives believe in, above all, is the effectiveness of free markets as ways to organize economic activity. Leave people free to make their own, Individual choices, say conservatives, and they will be far more productive and efficient than if you try to plan or direct their activities... But what if the collective result of those free choices is to lock in a bad result? What if we end up stuck with an inferior technology, or with an industry in the middle of a congested metropolis when it might better function in a new location?" p. 223

Krugman further asserts that the outcome of market competition often depends crucially on historical accident. Path dependence extends beyond technological matters. This research argues that path dependence affects the behavior of decision makers as well. For example, in the context of strategic alliance and formal cooperation one might see path dependence as available partners refusing to work with each other because of past experiences or traditions that may or may not relate to the proposed strategic alliance or formal cooperation arrangement. Another common form of path dependence is found when firms with common industry experiences face similar opportunities and constraints (Kogut and Zander 1996: p. 513). This version of path dependence is present when buyer-seller relationships are carried on over multiple generations.

Arthur (1988: p.10) posits four self-reinforcing mechanisms that contribute to path-dependence: (1) large setup or fixed costs, that give the advantage of falling unit costs as the output increases, (2) learning effects, that improve products or lower their costs as their prevalence increases, (3) coordination effects, that confer advantages to cooperation with economic agents taking similar action, and (4) adaptive expectations, where increased prevalence on the market enhances beliefs of further prevalence. If one technology is inherently "better" than the other (under some measure of economic welfare), but has "bad luck" in gaining early followers, the eventual outcome may not be of maximum benefit. Once a "solution" is reached, it is difficult from which to exit. This is what Arthur (1988: p. 10) calls "lock-in."

The following example is designed to make Arthur's self-reinforcing mechanisms more tangible. Consider the role of path dependence in choosing between a pest control strategy based primarily on chemical control and one based on integrated pest management[13] for cotton grown in Texas. Cowan and Gunby (1996) present a case study to illustrate the role of path dependence in the evolution of pesticides for controlling cotton pests in Texas:

> "The boll weevil has been a major pest to the cotton industry in Texas since the late 1890s. Originally Texas A&M University was commissioned to find a means for controlling the boll weevil. A series of cultural procedures based on a shortened cotton production season were proposed, implemented and proved highly effective. During the 1940s synthetic organic insecticides were developed, and several factors induced growers to switch from integrated pest management to chemical control. First, the costs of switching were low. Secondly, pesticides were perceived to give an almost constant stream of high crop yields compared to lower and more variable yields associated with integrated pest management. Thirdly, government policy moved to an agricultural system based on chemical control (e.g., set aside programs based on yield favored chemical control). Concern with yield rewarded high input growers, further moving growers away from cultural control to chemical control. Many growers began switching to high yield varieties that were less resistant to pests. Moving to these varieties of cotton made growers extremely susceptible to pests and lowered their pest damage thresholds. This reinforced the adoption of chemical control. A final factor is that cultural control, which was an integral part of integrated pest management, is subject to substantial network externalities since many cotton pests are powerful flyers and can travel large distances. As growers switched to chemical control it reduced the benefits of cultural control to existing growers, thereby making it more likely that they too would switch." p. 534-535

Cowan and Gunby go on to discuss how the boll weevil eventually became resistant to chemical control. Three separate cotton producing areas of Texas which relied on differing methods of pest control are compared using Arthur's four self-reinforcing mechanisms. Cowan and Gunby explain in detail why two of the three producing areas have found it quite problematic to switch away from chemical control methods in spite of the boll weevil's increasing resistance to chemical control. These elements of path

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[13]Integrated pest management, which includes chemical means, biological means, and crop rotation to control pests. Integrated pest management is based on responding to a set of current conditions. The focus is on economic rather than physical damage. The farmer constantly monitors his crop and the insect populations, making estimates of economic damage. If the damage threshold seems likely to be reached, the farmer decides which integrated pest management strategy will be the most effective and applies it.

dependence are likely to be present in some form in the case studies to be used in this research.

2.1.4.1 Path dependence and increasing returns to scale

Path dependence is closely linked to increasing returns to scale, especially as it relates to the adoption of competing technologies. The more a particular technology is adopted, the more experience is gained with it and the more it is improved. Many researchers have stated the existence of dynamic increasing returns implies path dependence, once chosen, has a tendency to become entrenched (Cowan and Gunby 1996; North 1992; Arthur 1988). However, these researchers also argue it takes more than just increasing returns to create path dependency. For example, historical details can be very important in understanding how institutions (defined in this research as institutional acceptability) evolve over time. Apparently minor details (seemingly insignificant events) can be amplified and drive the economy down one path as opposed to another. This suggests empirical work must be carried out at a very detailed level (Cowan and Gunby 1996: p. 521). This research posits that choice of vertical coordination strategy is subject to the same forces of path dependence as technological advancements in the economy. This research seeks to identify those seemingly minor events, of a path dependant nature, which take place in the lives of decision makers to gain insight into the decision making process.

In economics, it is well known that allocation problems with increasing returns may exhibit multiple equilibria. Static analysis can typically locate these multiple equilibria, but usually it cannot tell us which one will be selected. An adaptable approach can probably say more (Arthur 1989: p. 116). One objective of this research is the development of an adaptable model of vertical coordination decision making used to explain why a particular vertical coordination strategy (an example of multiple equilibria) is preferred, given the environment in which the decision maker operates.

2.1.4.2 Path dependence and the adoption of competing technologies and strategies

Central to the literature on theoretical work regarding the adoption of competing technologies has been the notion that the value of adopting a particular technology rises with the degree of adoption of that technology. This is the idea that if the majority is using a particular technology, it must be the best of available technology and should be adopted before alternative technologies. There are many examples of competing technologies resulting in the domination of a single technology such as VHS tapes over Beta, light water over gas-cooled nuclear energy, and QWERTY style keyboards over the Dvorak Simplified Keyboard. This research postulates that path dependence which applies to competing technologies can also be applied to the adoption of competing vertical coordination strategies.

The value of adopting a particular technology may rise if a particular technology has "externalities" in use, such that the net benefit of using a given technology increases with the number of agents currently using it, resulting in "excess inertia" (Farell and Saloner 1985; 1986). Farrell and Saloner refer to the idea that no agent is willing to adopt a technology without the knowledge that many others will also adopt it since such a move would mean leaving a large network to join a small or nonexistent one. Thus a system can become stranded on a possibly inferior technology unless some coordinating device appears. This process is commonly cited in development literature as the difference between early adopters and followers. Early adopters are usually few, and they are willing to take risks that most producers are not willing to take until they see how the adoption of a particular technology works for the early adopters.

Arthur (1989) addresses the issue of improving technologies. When technologies are improving, either through learning by using or learning by doing, experience with a technology will increase the benefits of adopting it. As more decision makers enter a specific vertical coordination strategy, more is learned about the use of the particular strategy making it even more attractive to future adopters than available alternatives. A snowballing effect can lock an industry of sequential adopters into one primary strategy.

Cowan (1991) examines a different type of learning which is a form of reduction of uncertainty regarding which of the possible technologies is preferable from the user's point of view. As experience with the competing technologies accumulates, estimates about their properties and relative merits become sharper, the incentive to use a technology thought to be less than the best, "just to learn something about it" declines, and the industry locks into one primary technology.

All three forces, adoption externalities, learning, and uncertainty reduction, operate as positive feedbacks, making technologies more valuable as the number of users increases. Systems that operate under positive feedbacks of this type tend to share three features: (1) path dependence, in the sense that long run equilibrium can be changed by historical events along the path to it, (2) inflexibility, in that as the process proceeds the ability to affect the outcome with small interventions disappears, (3) potential regret, which refers to the possibility of locking into a technology that does not provide maximum payoffs (Cowan and Gunby 1996: p. 523). Positive feedbacks associated with the choice of a vertical coordination strategy and the resultant properties will be investigated in the cases studies used in this research.

2.1.4.3 Concluding remarks regarding path dependence

Path dependence is a concept that is difficult to define, yet easy to recognize if seen. The most offered example of path dependence is the dominance of the QWERTY keyboard, dating from the first typewriters. Path dependence, as a concept, need not be limited to the study of technology. This research will apply path dependence to human interactions as well as technology. For example, the value of adopting a particular strategy is likely to rise with the degree of adoption of the particular strategy. The value of adopting a particular vertical coordination strategy may rise if the net benefit of using the strategy increases with the number of agents currently using it. Finally, when strategies are improving, either through learning by using or learning by doing, experience with a strategy will increase the benefits of adopting it.

The detailed case study nature of this research lends itself to the inclusion of path dependence as a possible explanatory variable. The search for path dependence will be explicitly applied to the programmability, implementability, and acceptability of the risk/return tradeoffs associated with alternative vertical coordination strategies under the proposed framework.

2.2 A Recent Vertical Coordination Strategy Framework: The Mahoney Framework

Within the agricultural economics literature, Barkema (1994), Martin et al. (1993), and Boehlje and Schrader (1994) have all attempted to define criteria that help a firm decide between open markets and managed coordination (e.g., vertical integration). However, these attempts were only partially designed to address the finer decisions between the various forms of managed coordination. Scholars from the economics, strategic management, organization science, as well as, other behavioral fields have also put forth theories of the firm (see Coase 1937; Eisenhardt 1985 1989; Milgrom and Roberts 1992; Rumelt 1984; Williamson 1975 1985).

From the discipline of strategic management, Mahoney (1992) has constructed an extensive theoretical derivation of eight coordination strategies based on three conditions he argues are sufficient to specify coordination mechanisms. He draws upon positive agency, organizational economics, property rights, and resource-based theory to justify his three conditions. The framework proposed in this research was motivated in large part by Mahoney's work on predicting the organizational form of vertical control as presented in a 1992 Strategic Management Journal article. What follows is an overview of the Mahoney framework. Mahoney's conditions in their dichotomous form:

Nonseparability

Low nonseparability:	The contribution of individual efforts can be clearly separated through output measurement; therefore, individual rewards can be fairly distributed and a manager is not required to monitor shirking.
High nonseparability:	The contribution of individual efforts *cannot* be clearly separated through output measurement; therefore, individual rewards *cannot* be fairly distributed without a manager to monitor shirking.

Task Programmability

Low task programmability:	The product transformation process is *not* well established or routine; therefore, input measurement is uncertain and not amenable to monitoring.
High task programmability:	The product transformation process is well established and routine; therefore, input measurement is fairly certain and amenable to monitoring.

Asset Specificity

Low asset specificity:	Human, physical and/or site investments are not particularly firm/strategy specific.
High asset specificity:	Human, physical and/or site investments are quite firm/strategy specific.

Table 2.1 presents Mahoney's strategies organized along the continuum as defined in this research. Mahoney's strategies match the proposed continuum well. Low levels for each of his three variables map into the spot market end of the continuum while high levels for all three map into the vertical integration end. The mixed strategies for the three factors fall in between. For example, when tasks are output separable (low nonseparability) and assets have low specificity (little chance for opportunism), the spot market works well irrespective of programmability (it can be high or low). Even when programmability is high, there is little incentive for taking on the cost of managed coordination when outputs are easily measured and the risk of opportunism is remote. In contrast, when the risks of opportunism are high (high asset specificity) and outputs are easily separated (low nonseparability) and inputs are not easily measured (low programmability), there is incentive to manage the specifications of exchange through long-term contracts; but, no incentive exists to establish formal internal organization because the low programmability will keep such organizations from being effective.

Table 2.1: Coordination Strategies Based on Nonseparability, Programmability, and Asset Specificity

Research Continuum Strategy	**Spot Market**	**Specification Contracting**	**Strategic Alliance**	**Formal Cooperation**			**Vertical Integration**
Mahoney's Recommended Strategy	*Spot Market*	*Long-term Contract*	*Relational Contract*	*Inside Contract*	*Clan*	*Joint Venture*	*Hierarchy*
Asset Specificity	Low Low	High	Low	Low	High	High	High
Nonseparability	Low Low	Low	High	High	High	Low	High
Programmability	Low High	Low	Low	High	Low	High	High

Source: Adapted from Mahoney, Joseph T. The Choice of Organizational Form: Vertical Financial Ownership Versus Other Methods of Vertical Integration, Strategic Management Journal, vol. 13 1992, p. 576.

Similar arguments can be advanced (and Mahoney does so in his article) for each of the other strategies along the continuum. One of the more interesting observations based on this reorganization of Mahoney's eight cases is that three of them fall into the formal cooperation category, and all three exhibit high scores on two of Mahoney's three criteria. This suggests the existence of tradeoffs among the criteria that are all consistent with some form of formal cooperation. Formal cooperation may be one of the richest portions of the continuum in terms of further research efforts and future vertical exchange behavior among firms.

If Mahoney's approach is to be accepted, individual firms should assess each of their exchange relationships with others to determine the degree of nonseparability, task programmability, and asset specificity. With this assessment complete, an appropriate coordination strategy could then be chosen and pursued. Mahoney appears to have established a normative framework that makes clear prescriptions about firm-level coordination strategy.

2.2.1 The sufficiency of the Mahoney framework

Mahoney (1992) argues that from a pure efficiency stand point, transaction and agency costs (asset specificity and task programmability, and non separability in this case) are crucial in determining organizational form:

> "In order to predict and prescribe organizational form **from an efficiency perspective**, the necessity of analyzing positive agency and transaction costs is undeniable. In fact, if one accepts the premise that the environment selects out those firms that use relatively efficient governance structures (Nelson and Winters 1982), then the conclusion that transactions costs critically determine is not an assertion (Pfeffer 1982) at all. It is, in fact, a tautology." (p. 571)

The proposed framework regards transaction and agency costs to be important. However, this research posits that choice of vertical coordination strategy is based on more than just efficiency considerations.

Is Mahoney's approach adequate to the task? Martin et al. (1993) present a related scheme of strategies created by using risk, trust, and competence as their criteria. Many effective arguments can be offered for the relevance of these criteria. However, Mahoney argued that risk does not translate into a determinant set of strategy recommendations, and it might be argued that competence and trust are sub-elements of task programmability and nonseparability. Even so, Martin et al. still provide grounds for speculating about the sufficiency of Mahoney's conditions. Boehlje and Schrader (1994) also speculate on a number of additional conditions that influence the contract/ownership decision including: (1) increased specificity of consumer demand, (2) increasing product diversity, (3) supply/demand risk, (4) the need for rapid transmission of information, and (5) the biological capacity of the product to respond to changing consumer demands.

Given the evolving nature and behavioral aspects of vertical coordination strategies, there is reason to advance several other criteria, besides Mahoney's that may serve useful to better understanding the nature of decision making along the continuum. These criteria arise from focusing more on "how to make managerial decisions" and is distinct from predicting organizational form. The rest of the chapter is devoted to presenting the framework regarding the decision process for altering a vertical coordination strategy.

2.3 The Proposed Theoretical Framework Regarding the Decision Process for Altering a Vertical Coordination Strategy: An Intuitive Explanation

Mahoney's framework provides a theoretical explanation for *what choice* of vertical coordination strategy a decision maker *should make*, based on transaction cost economics and positive agency theory. Mahoney's framework is not a model of *how or why decision makers arrive at the choices they do*. What theory suggests decision makers should do and what they actually do can be two different things (Wysocki, 1997).

Mahoney's logic is compelling, regarding the appropriate choice of vertical coordination strategy, given the levels of asset specificity, nonseparability, and task programmability. Although Mahoney's arguments provide a solid theoretical foundation for choice of organizational form, they may be too deterministic and rigid to capture the dynamic nature of human decision making. This research seeks to capture the complex nature of decision making and to close the gap between theory and observed behavior.

Before outlining the components of the proposed framework, an intuitive explanation of the rationale behind the framework is in order. This explanation for the proposed framework is offered to establish the "face validity" of the framework. This intuitive explanation is followed be a detailed explanation of the proposed framework regarding the process for altering a vertical coordination strategy.

The intuitive explanation begins with a brief profile of a typical producer decision maker who has been utilizing a particular vertical coordination strategy, at a specific transaction interface, at a given point in time. After this profile is laid out, the effects of the changing nature of agriculture are juxtaposed against the proposed framework. This section concludes with an overview of each decision node to illustrate the process a decision maker might use in considering alternative vertical coordination strategies.

2.3.1 The current vertical coordination strategy: a starting point

There may be many reasons why the decision maker has chosen a particular vertical coordination strategy. A vertical coordination strategy may have been used by the decision maker for many years, or the decision maker may be comfortable with a certain vertical coordination strategy at a particular transaction interface. Occasionally, vertical coordination strategies are established and maintained over multiple generations. For example, the decision maker's grandfather and father may have done business with a particular firm. The decision maker may find himself doing business with the same firm, in the same manner, such as, spot market sales, because it is the way it has always been done (i.e., the decision maker's choice may contain elements of path dependence).

Economic theory and empirical observation suggest decision makers are also driven by profit motives. They want to maximize their profits. There is often a tradeoff between profit potential and level of risk associated with a given strategy and thus profit motives can be refined to include the notion of expected or risk-adjusted profits. One can speculate the tradeoff between the risk and profit generated by a currently selected vertical coordination strategy has been acceptable to the decision maker or efforts would have been made to select an alternative strategy.

The decision maker profile described above illustrated the concepts of path dependence and risk/return tradeoff. It would also seem reasonable that a decision maker might consider how manageable and implementable alternatives are in determining the acceptability of a current coordination strategy. Figure 2.1 incorporates all these factors into a decision flow diagram that will ultimately be argued to be the needed framework for studying vertical coordination decisions.

Having established a starting point, an effective way to illustrate the intuition behind the proposed framework is to follow the decision maker through the process of altering a vertical coordination strategy. Figure 2.1 suggests a specific order to the decision process. For example, the decision regarding the risk/return tradeoff is depicted as taking place just before the adoption of an alternative vertical coordination strategy. An argument could be made for placing this decision node earlier in the framework. Perhaps, the order of the second, third, and fourth decision nodes are interchangeable. The order presented in Figure 2.1 will be argued to be intuitively appealing and will be tested as part of the research design.

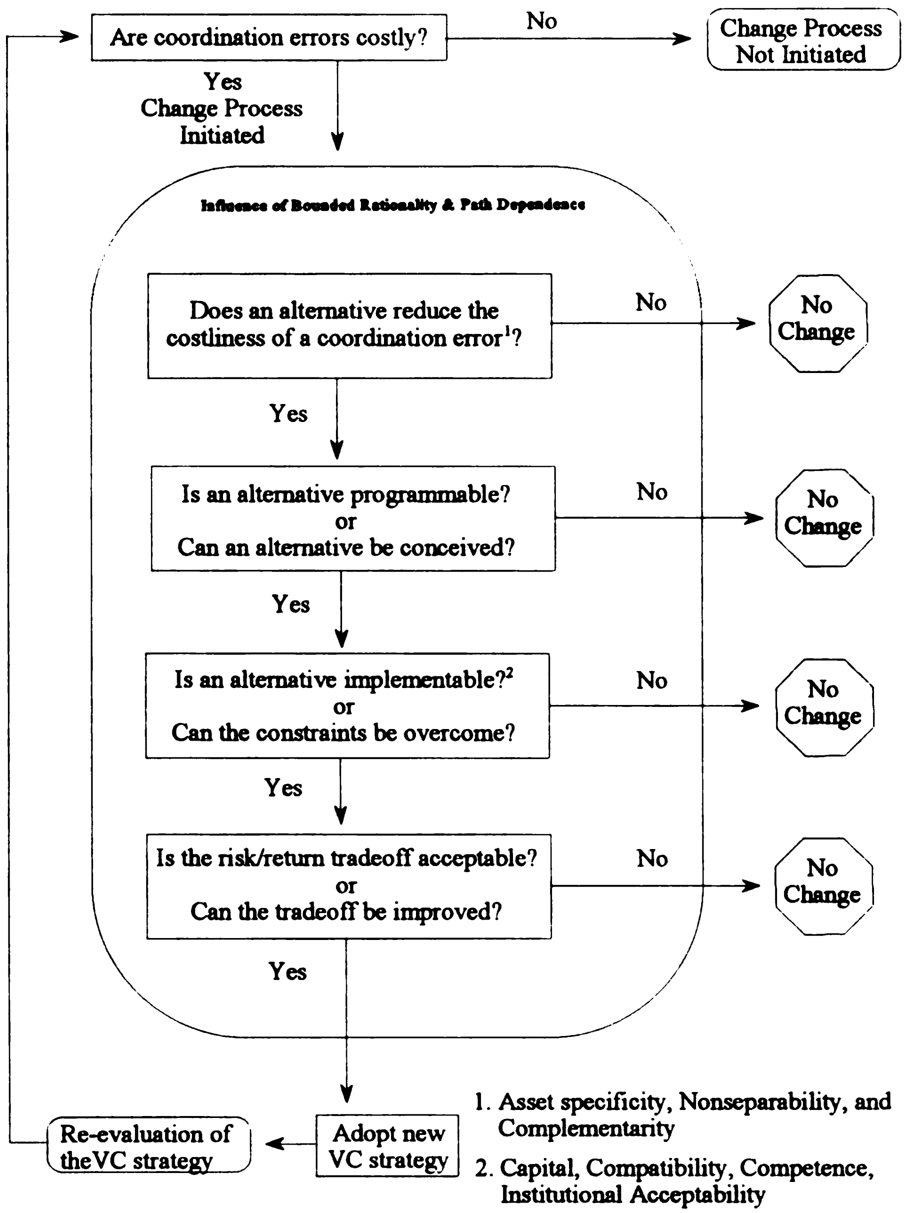

Figure 2.1 The Decision Process for Altering a Vertical Coordination Strategy

2.3.2 An uneasiness about the decision maker's current situation

The decision maker initiates the process of change when they are no longer satisfied with the outcomes of their transacting with others in the value chain. They are uneasy about their current situation and that may be a result of the same forces driving the industrialization of agriculture as described in the first chapter. For example, the decision maker may witness farmers who have traditionally provided undifferentiated products and services, now operating more profitably in markets evolving toward differentiated products and services under a system of tighter vertical coordination.

This uneasiness increasingly transforms itself into an awareness that coordination errors are costly between the decision maker's firm and a supplier or the decision maker's firm and a buyer at a particular transaction interface. The decision maker may show up at the marketplace only to find that he or she cannot sell goods under reasonable terms and conditions.

What leads to the costliness of a coordination error? Consider a potato producer who has invested in highly specialized planting and harvesting equipment that are only used in potato production (a form of high asset specificity). Over the last five years this potato producer has sold most of his crops to a local retail grocery chain who has successfully differentiated itself based on selling "local" products (a form of high nonseparability). One day, the retailer announces they are going out of business and will no longer be needing potatoes from area potato growers. This potato grower is now in a state of panic because he had increased his potato acreage and investment in specialized equipment. He wonders where he will find another partner to replace the retailer. In this case, the cost of a coordination error (the combination of investment in specialized equipment, the reliance on a particular partner, and the loss of that partner) are high.

Consider a second example where a corn producer has planting and harvesting equipment which is easily adopted for alternative uses (a form of low asset specificity). This corn producer has historically sold the majority of his crops to many different buyers on the open market who have many options for purchasing the same commodity corn (a form of low nonseparability) after harvest. One day, the local grain elevator announces they are closing down the plant and will no longer be buying corn from the corn producer. This corn producer is saddened by the loss of the buyer, but believes there are many other firms who will buy corn. In this scenario, the cost of a coordination error (the combination of relatively little investment in specialized equipment, the reliance on many buyers, and the loss of a single buyer) is low.

It is the level of asset specificity and nonseparability in the transaction which leads to a costliness of a coordination error (asset specificity and nonseparability will be discussed in detail in section 2.4.1.). If a coordination error is costly at a given transaction interface under the current vertical coordination strategy, the decision maker will initiate the process of change. However, if a coordination error is not costly at this interface under the current vertical coordination strategy, the decision maker will not initiate a process of change.

2.3.3 Can the perceived costliness of a coordination error be reduced?

Having determined that the costliness of a coordination error is significant, the decision maker must now look for ways to reduce the costliness of a coordination error.

Varying the intensity of the control over the transaction may help to reduce the costliness of a coordination error. In Chapter 1, it was suggested that varying the intensity of control in a transaction is accomplished by changing vertical coordination strategy.

Returning to the potato producer example of the last section, the high cost of a coordination error becomes the catalyst for beginning the search for an alternative coordination strategy. The producer wonders if contracting with a local processor is a good idea, or if joining a local potato marketing cooperative might help to reduce the costliness of a coordination error.

If the decision maker believes that the costliness of a coordination error can be lessened by choosing an alternative vertical coordination strategy, the decision maker will answer yes to the first node in the decision process and be prepared to move on to the second node. If the decision maker does not believe that the costliness of a coordination error produced by asset specificity and nonseparability can be reduced by selecting an alternate vertical coordination strategy, then there is no reason to change from the current vertical coordination strategy.

2.3.4 The existence of alternate management routines

Suppose the decision maker is dissatisfied about staying with the current vertical coordination strategy and he or she believes an alternative vertical coordination strategy could reduce the costliness of a coordination error. The decision maker must now find out if effective management routines exist for a specific alternative or can he or she conceive of a manageable alternative? For example, a decision maker utilizing a spot market coordination strategy in the selling of hogs might easily identify a number of alternative vertical coordination strategies, such as, a neighbor involved in: (1) a marketing contract with a local processor or (2) a cooperative that has formed a strategic alliance with a regional hog processor/marketer.

In the above example, the decision maker could adopt the strategy associated with selling hogs via a marketing contract, or joining a cooperative. However, it is possible that alternatives are not readily known or they may not even exist. In this case, the decision maker wonders if alternative strategies could be developed. Are there people or other sources of information the decision maker can look to for the creation of alternative strategies where none currently exist? If alternatives cannot be conceived, there is no reason to switch from the current vertical coordination strategy.

Whether or not an alternative strategy is conceivable depends on what Mahoney calls programmability. If the decision maker wants to explore alternative vertical coordination strategies but does not know any programmable alternatives, then the decision maker reaches an impasse and is in effect "stuck" with the current vertical coordination strategy.

2.3.5 The feasibility of alternative vertical coordination strategies

Assume the decision maker believes an alternative strategy will reduce the costliness of a coordination error and that an alternative strategy is programmable. The decision maker now must consider if the alternative can be implemented. Implementability is a question of feasibility in the specific circumstances of the decision maker. While there are many components of implementability, four factors stand out a priori: capital, compatibility, competence, and institutional acceptability.

An alternative vertical coordination strategy may not be implementable because the absolute level of capital required for the strategy is not available to the decision maker. For example, a vertical coordination strategy may require the purchase of highly specific and expensive assets. An individual producer probably cannot raise the needed capital alone, but if the producer belonged to a cooperative, the cooperative might raise enough capital. Formal cooperation thus becomes a more implementable alternative than a spot market.

Certain vertical coordination strategies, such as strategic alliances, require the existence of potential partners to share a common organizational culture, the same values, philosophies, and the ability to approach day-to-day business from the same strategic point of view. These characteristics describe cultural and strategic compatibility. The levels of compatibility between a decision maker's firm and potential partners help to define the range of implementable vertical coordination strategies.

The ability and willingness (coordination competence) of decision makers to adopt alternative vertical coordination strategies also affect implementability. Different strategies require different kinds of competence from the decision maker. For example, the decision maker may be skilled in "on the spot" dickering, while a strategy based on contracts requires more monitoring and attention to details than it does dickering. Not only does the decision maker have to possess the correct skills to be successful using a specific strategy, the decision maker must also be willing to use these skills. Coordination competence is the interaction between ability and willingness, and thus helps define the implementable range of vertical coordination strategies.

The final component of implementability is institutional acceptance. Decision making takes place within the context of institutions. How organizations operate and function can be directly influenced by institutional arrangements. For example, antitrust laws established by the Sherman Act and enforced by the judicial branch of our government may prohibit certain types of coordination strategies (i.e., in the case of a merger leading to a monopoly). There are subtle forms of institutional acceptability which are closely related to path dependence (e.g., unwritten and long-standing agreements between a university plant breeder and a state's producers regarding the producers "right of first refusal" regarding the release of new plant varieties generated by the breeder). This interconnectedness is explained in greater detail in the next section.

If one or more of the components of implementability are overly constraining, the decision maker will choose not to switch from the current vertical coordination strategy. The decision maker must ask a second question regarding implementation that is similar to the second question asked under programmability. Can the constraints which are found to make alternative strategies un implementable, be overcome? For instance, the decision maker could learn to adopt more of a partnering approach. If these constraints cannot be overcome, the current vertical coordination strategy will remain in place.

2.3.6 Comparing the current risk/return tradeoff to alternative risk/return tradeoffs

If an alternative strategy has been found to reduce the costliness of a coordination error, to be programmable, and implementable, the decision maker is almost ready to adopt the alternative strategy. The decision maker has yet to compare the risk/return tradeoff of the current vertical coordination strategy to that of an alternative strategy.

This fourth decision node is based on the decision maker's attempts to measure the relationship between the levels of profit and risk associated with current and alternative vertical coordination strategies. The acceptability of any particular risk/return tradeoff is based on a decision maker's preference for risk, and as such, can be highly subjective.

If the decision maker does not find the risk/return tradeoff for an alternative vertical coordination strategy acceptable, then a new vertical coordination strategy will not be adopted. However, the decision maker may explore ways to improve the risk/return tradeoff. Having reached this stage in the framework, if such an improvement can be identified, the decision maker is ready to adopt a new vertical coordination strategy.

Figure 2.1 also allows for a feedback loop. This suggests that strategy can be re-evaluated over time. Decision makers are likely to be constantly evaluating and re-evaluating their choice of vertical coordination strategy as the economic environment changes the nature of vertical relationships.

2.3.7 Concluding remarks regarding the intuitive explanation of the proposed framework

There may be many reasons why a decision maker has chosen a particular vertical coordination strategy, including, but not limited to path dependence and the acceptability of the risk/return tradeoff. Decision makers may decide to explore alternative vertical coordination strategies for different reasons. Although the initial reasons for considering a change in vertical coordination strategy may vary according to the decision maker, the decision process for choosing an alternative vertical coordination strategy is hypothesized to remain the same.

Decision makers begin the decision process for altering a vertical coordination strategy because they are uneasy about relying on their current strategy. This uneasiness may be due in part to the forces behind the industrialization of agriculture, and can be described as an unacceptable costliness of a coordination error at the transaction interface. Costliness of a coordination error is affected by the levels of asset specificity and nonseparability present at a given transaction interface.

The decision maker must find out if alternative strategies are programmable. If programmable alternatives do not exist, or cannot be conceived, the decision maker is stuck with the current coordination strategy. However, if these alternatives exist in theory or practice, the decision maker is ready to consider the next decision node.

The decision maker must now determine if alternative vertical coordination strategies are implementable. Four factors of implementability include: capital, compatibility, competence, and institutional acceptability. An alternative vertical coordination strategy will not be implementable if any of these factors are overly constraining. If the factors are not constraining, or the constraints can be overcome, the decision maker will go on to the final decision node.

The final decision node compares the risk/return tradeoffs of the current vertical coordination strategy to the risk/return tradeoffs of alternative strategies. If the decision process reaches this decision node, an alternative vertical coordination strategy will be adopted: (1) if it has a more acceptable risk/return tradeoff than the current strategy, or (2) if the risk/return tradeoff of an alternative strategy can be improved to become more acceptable than the current vertical coordination strategy. Decision makers can constantly reassess their vertical coordination strategy decision, and as a result, often repeat the decision process for altering a vertical coordination strategy.

This intuitive explanation has attempted to establish the face validity of the proposed framework, and now detailed development of the framework will be provided. The purpose of the detailed explanation is to present the framework in its entirety and to illustrate the linkages between theory and the decision making process for altering a vertical coordination strategy.

2.4 The Proposed Theoretical Framework Regarding the Decision Process for Altering a Vertical Coordination Strategy: A Detailed Explanation

The starting point regarding the decision process for altering a vertical coordination strategy is the current vertical coordination strategy being applied at a particular transaction interface. A transaction interface occurs at the linkages which make up a product/service value chain.

The proposed framework (see Figure 2.2) consists of a catalyst for initiating the process of a change in vertical coordination strategy and four decision nodes where the decision maker must ask the following questions: (1) does an alternative reduce the costliness of a coordination error?, (2) is an alternative programmable or can an alternative be conceived?, (3) is an alternative implementable or can the constraints be overcome?, (4) is the risk/return tradeoff of the alternative acceptable or can the tradeoff be improved?

If coordination errors are costly under a current strategy (resulting in the initiation of the change process) and if the decision maker can answer yes at all four decision nodes,

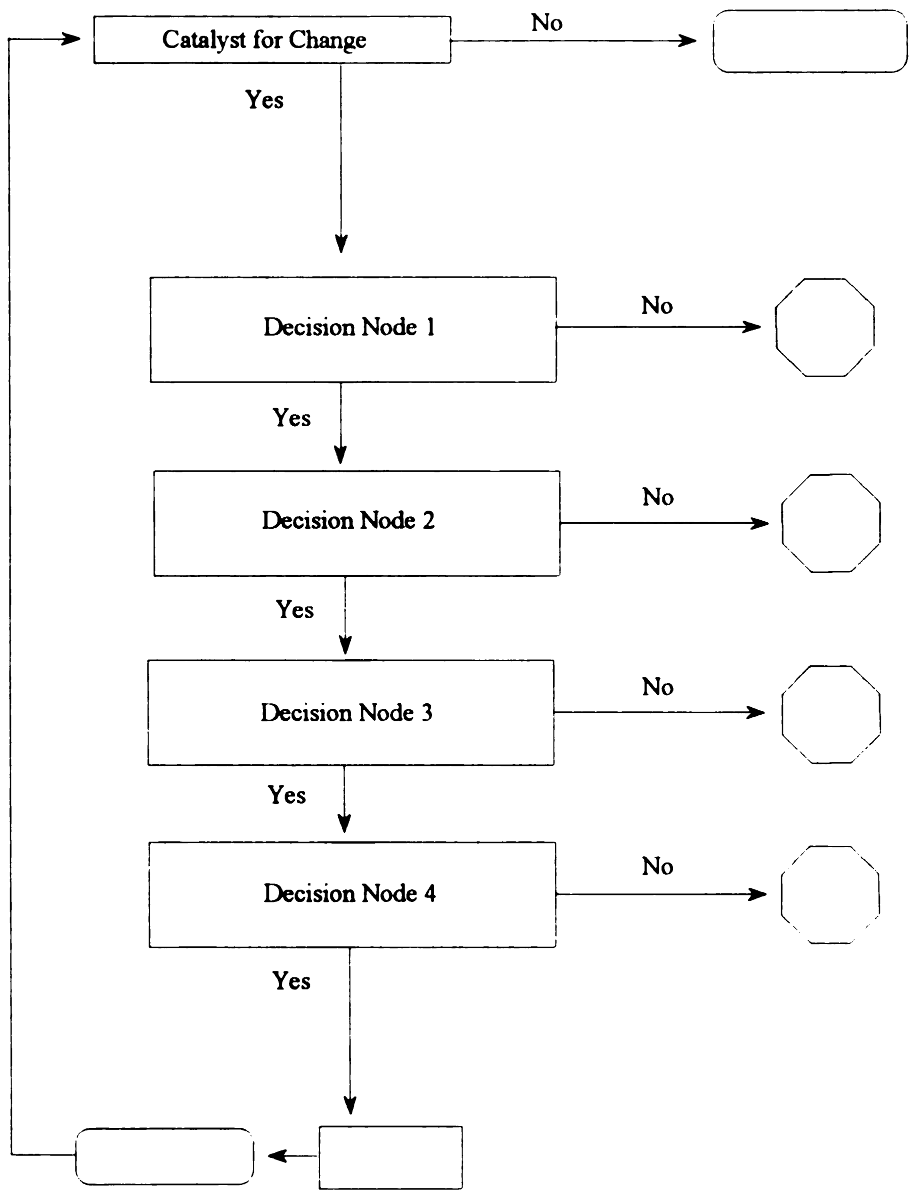

Figure 2.2 **The Catalyst for Change and the Four Decision Nodes for Altering a Vertical Coordination Strategy**

then an alternative strategy should be adopted. Finally, there is a feedback loop in the proposed framework. The decision maker must constantly re-evaluate the newly adopted vertical coordination strategy resulting in the decision process being conducted again. The catalyst for change and the four decision nodes will be discussed in detail in the following subsections.

2.4.1 How costly is a coordination error?

In section 2.3.2 the initiation of a change in vertical coordination strategy was described as an uneasiness about the current vertical coordination strategy, but what does this mean? In the proposed framework (see Figure 2.3), this uneasiness is labeled as "How costly is a coordination error?" Coordination errors are those situations in which price, quantity, quality, and terms of exchange become misaligned so that an expected transaction fails to take place.

The costliness of a coordination error arises from at least three factors: (1) the search cost for an alternative transaction partner, (2) the loss of value of goods or assets related to the failed transaction, and (3) the costs necessitated by entering into an alternative transaction. For example, a seed potato producer may find herself at the end of a growing season with unsold seed potatoes because a contract buyer failed to perform. It may require considerable effort by the seed potato producer to find willing buyers for those seed potatoes which are not already sold. Given the perishability of the seed (temporal asset specificity), the seed potato producer faces a loss of value if she cannot find a willing buyer in a timely fashion after harvest. The decision maker may also incur

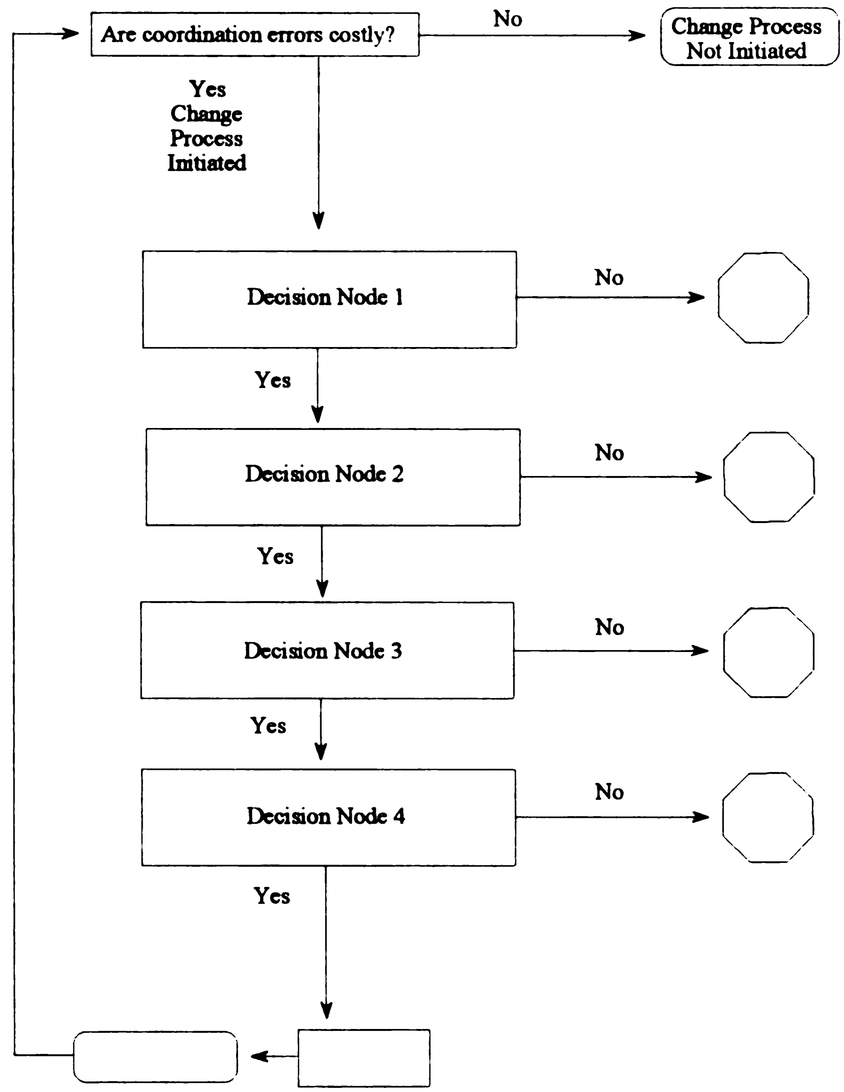

Figure 2.3 The Catalyst for Initiating a Change in Vertical Coordination Strategy

additional costs associated with an alternative transaction such as hiring marketing expertise to sell the crop in a timely manner.

Based on Mahoney and Milgrom and Roberts, it can be argued that the costliness of a coordination error is based on the levels of asset specificity and nonseparability that are present in the transaction. The costs associated with asset specificity and nonseparability may reach a level where the decision maker believes these costs could be made more acceptable by changing vertical coordination strategies. For example, it is well documented (Anderson 1985; Armour and Teece 1980; Caves and Bradburd 1988; John and Weitz 1988) that given increased levels of asset specificity, the costs of conducting economic exchange within a firm (i.e., vertical integration) may be less than the costs of organizing exchange in the market (Coase 1937 and 1960; Williamson 1985). Figure 2.4 shows the relationship between asset specificity, nonseparability and the costliness of a

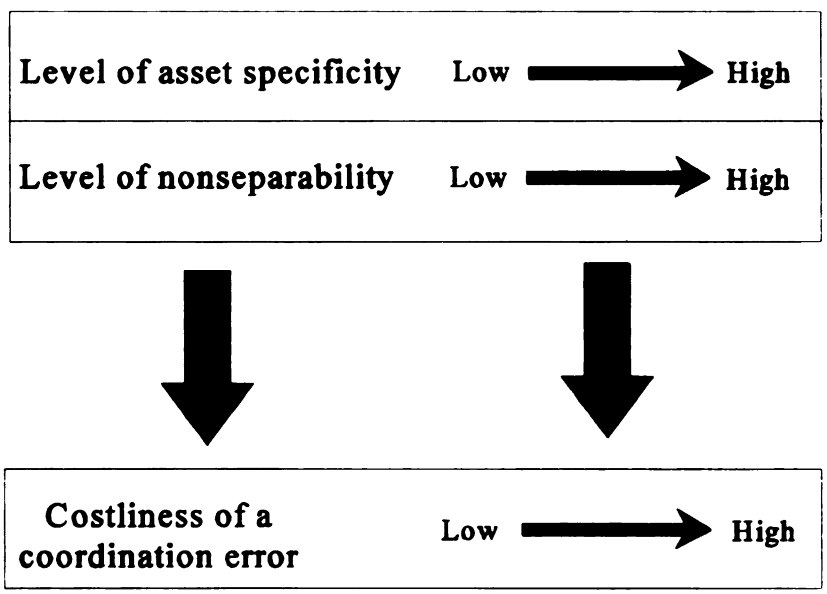

Figure 2.4 The Relationship Between Levels of Asset Specificity, Nonseparability, and the Costliness of a Coordination Error

coordination error. When asset specificity and nonseparability are low in a transaction, the costliness of a coordination error is low. The costliness of a coordination error increases as the levels of asset specificity and nonseparability increase until it becomes high in transactions where both asset specificity and nonseparability are high. The arguments which support this relationship will be presented later in this chapter. But first, asset specificity and nonseparability need to be sufficiently defined.

2.4.1.1 Asset specificity

Asset specificity refers to the transferability of the assets that support a given transaction (Williamson 1985). Asset specificity is the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value. Unlike general purpose assets (e.g., general purpose machinery and capital) which can be freely transferred across applications, transaction specific assets are tailored to a particular user (transaction) and thus are valuable only in a narrow range of alternative uses. The narrower the range, the more specific the asset (Klein, Crawford, and Alchain 1972). Assets with a high amount of specificity represent sunk costs which have little value outside a particular exchange relationship.

Transaction cost theory states that when assets are not closely tied to a specific strategy, market and informal means of coordination will be preferable to hierarchical strategies. Vertical financial ownership makes sense only when assets are idiosyncratic and closely tied to a specific strategy (Williamson 1985). For example, this researcher was once a co-owner of a produce distribution firm. The building used to house the produce was converted from a potato storage warehouse. As a potato warehouse, this building had many alternative uses such as storage for machinery, bags, grain, and fertilizer. Once the building was converted to a produce distribution center, complete with automated racking, its alternative uses were extremely limited without costly adoption.

Williamson (1991) has identified six main types of asset specificity: site specificity, physical asset specificity, human asset specificity, brand name capital, dedicated assets, and temporal specificity. The definitions of these six types are:

> *Site asset specificity*: Occurs when unique locational advantages exist (e.g., tree fruit production in Michigan that is located in a narrow strip around the great lakes that surround lower Michigan).
>
> *Physical asset specificity*: Requirements for specialized machine tools and equipment that create value.
>
> *Human asset specificity*: The level of uniquely related learning processes, specialized knowledge or experience. May include the amount of teamwork needed to create value.
>
> *Brand name specificity*: Specialized knowledge (e.g., confidential information) and relationships built over time by the agents distributing the brand in question.
>
> *Dedicated assets*: Discrete investments in a general purpose plant which are made at the request of a particular customer.
>
> *Temporal or time specificity*: Occurs when the use of assets is dependent upon the timing of their use. For example, produce, because of its perishability must be harvested, sold, and consumed within a limited amount of time, and is subject to hold up costs.

In this research, Williamson's six types of asset specificity are combined with Anderson's (1985) three extensions of asset specificity arising from a marketing context. Asset specificity arising out of a marketing context include:

> *Company nature specificity:* A measure of how complex, unusual, or bureaucratic a company's operating procedures are.
>
> *Product specificity*: How long it takes to learn product lines, and how technical and/or how fast products change, are customized, unique or complex.

Customer nature specificity: Based on how much need there is in getting to know customers and how complex and sophisticated customers are.

The nine definitions above illustrate how asset specificity has come to be defined broadly. This research will be designed to recognize the various types of asset specificity which may affect choice of vertical coordination strategy.

2.4.1.2 *The presence of nonseparability*

Nonseparability is present at a transaction interface when the marginal value product cannot be identified from individual activities at the transaction interface. Nonseparability exists when the combining of individual activities (across the transaction interface) yields an output larger than the sum of outputs generated by individual activities less the cost of combining the activities (Alchain and Demsetz 1972). That is, complementarities exist between certain combinations of individual activities. Alchain and Demsetz use the following example to illustrate nonseparability:

> "Two men lift heavy cargo into trucks. Solely by observing the total weight loaded per day, it is impossible to determine each person's marginal productivity. With team production or activities that are not easily separable, it is difficult, solely by observing total output, to either define or determine each person's contribution to this output of cooperating inputs. The output is yielded by a team, by definition, and is not a sum of separable outputs of each of its members." p. 779

In economic terms, the production function is not separable into two functions each involving only input A or only input B. The combining of inputs to create team production, changes the production function, so that one cannot directly compare the marginal value product between production functions based on combined inputs versus production functions based on individual inputs. There is a source of gain from cooperative activity involving working as a team or combining activities across the transaction interface, in which individual cooperating units do not yield identifiable, separate products which can be summed to measure total output.

Economically speaking, it is possible to measure the marginal product of team effort, but not of the effort of individual team members. The costs of metering or ascertaining the marginal products of the transaction is what suggests new organizations and procedures (Alchain and Demsetz 1972: p. 780). When nonseparability is present at a transaction interface, alternative vertical coordination strategies may be suggested.

The cause of nonseparability in a transaction is complementarity (Milgrom and Roberts 1992). The standard definition of complementarity in economics is market oriented. Two products are said to be complements if a decrease in the price of one causes an increase in demand for the other. A relationship between inputs that is complementary implies both inputs must be used in the production process in order to create the desired output. For example, in order to make water, two hydrogen atoms are combined with one oxygen atom. No other combination will result in the formation of water. Some agricultural examples of input compliments include: tractor and plow, chemical combinations or compounds, tires and wheels, and wire and posts (Harsh, Connor, and Schwab 1981: p. 35). The changing nature of agriculture may be creating complementary relationships at transaction interfaces where none existed before.

Harsh, Connor, and Schwab extend the concept of complementarity to include alternative production relationships between enterprises. In Figure 2.5, the complementary relations between enterprises are shown. With the complementary relationship, an increase in one product causes an increase in the second product when the total amount of an input is held constant. An example is the relationship between a legume such as alfalfa and rotation cash crops where the nitrogen supplied by the legume decreases the inputs costs of producing the cash crop. Complementary enterprises must eventually become competitive (point A), because as a larger amount of the resource is allocated to any one product, the production of the other product will be hampered by lack of the variable input. This definition of complementarity is consistent to the one used in this research.

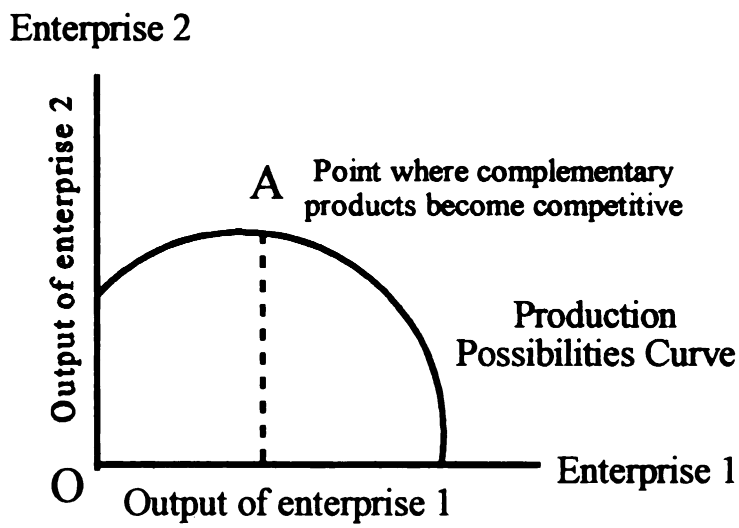

Figure 2.5 Complementary production relationship between enterprises

Source: Harsh, Connor, and Schwab, *Managing the Farm Business* (1981)

In order to employ the concept of complementarity to study choices of levels of various internal activities as well as levels of input purchases, we introduce an alternative, more inclusive, definition: Several activities are strongly complementary if doing more of any one activity increases (or at least does not decrease) the marginal profitability of each other activity in the group (Milgrom and Roberts 1992: p. 108). When the resources of the transaction reinforce each other and the transaction interface exhibits strong complementarity, the total output will be greater than the output from the sum of individual activities.

Nonseparability/complementarity can be caused by a number of factors. This research postulates two sources of nonseparability/complementarity based on transactions cost theory, agency theory, and resource-based theory: (1) a firm's sustainable stand-alone competitive advantage being highly vulnerable to competitive pressures (e.g., the firm possesses weak stand-alone competitive advantage) and linkages exist with firms on the other side of the transaction interface which could overcome the vulnerability, or (2) the need for high final consumer responsiveness by a product/service value chain. Each of these concepts is discussed below.

2.4.1.2.1 Sustainable competitive advantage (relative market power)

The resource-based theory of the firm has much to contribute to the discussion of competitive advantage because it is concerned with questions of bundling idiosyncratic resources to obtain sustainable competitive advantage. If the firm has a significant sustainable competitive advantage as a stand-alone organization (e.g., market power, highly differentiated products, proprietary technology), then the incentive to move toward intensive (managed) coordination is less strong. If the firm needs the cooperation of others in the value chain to achieve and sustain competitive advantage, then the incentive toward intensive (managed) coordination is stronger. It is the combination of the vulnerable competitive advantage and the access to linkages on the other side of the transaction interface that leads to nonseparability/complementarity. Without access to linkages that can overcome or limit the vulnerability of the firm's competitive advantage, the combining of individual activities will not yield an output larger than the sum of output generated by separating the activities. The transaction interface remains, in effect, separable. Evolving agri-food markets may be creating circumstances in which competitive advantage will often need to arise from cooperative, as opposed to stand-alone, efforts.

An example will help to illustrate this relationship. Consider a turkey processor with a highly differentiated product. If the processor's ability to differentiate the product is linked to the quality of the product the processor buys from upstream suppliers, the processor's sustainable competitive advantage (i.e., a differentiated quality product) may be limited by (vulnerable to) the ability of its downstream suppliers. In this case, the processor may decide to vertically integrate to increase the sustainability of its stand-alone competitive advantage.

Sustaining stand-alone competitive advantage is directly linked to the outcome of proper strategic analysis, which owes much to the work of Michael Porter (see Porter 1980). Proper strategic analysis helps to correctly identify the strength and extent of stand-alone competitive advantage. Stand-alone competitive advantage is a relative concept in that stand-alone competitive advantage is relative to both the internal and external environment facing the decision maker and the firm.

2.4.1.2.2 The need for final consumer responsiveness

Most of the usual arguments presented about positioning along the vertical coordination continuum focus on cost and efficiency issues. Mahoney himself notes that one limit to his approach is that all three of his criteria are efficiency derived. What if effectiveness in the value chain is as critical as efficiency? Governance decisions and choice of vertical coordination strategy, beyond being based on the examination and reduction of: (1) cheating and shirking costs (the focus of positive agency cost theory), and (2) other transactions costs (the focus of transaction cost analysis) should also address benefit considerations. There is more to decision making than just cost minimization. Firms resort to a mix of governance structures not only because it is too costly to limit shirking or cheating but because there are benefits to market-like and firm-like governance, beyond, lowering shirking and cheating (Madhok 1996: p. 582). Responsiveness to final consumer demands is one characteristic cited for evolving agri-food markets (Barkema 1994). This research incorporates the need to be responsive to final consumers as a component of nonseparability.

In Chapter 1, consumers were described as becoming increasingly demanding of the U.S. food system and as a result, the need for responsiveness has continued to grow across the food system. As the need for responsiveness increases, so does the costliness of coordination errors resulting from increased search costs for an alternative transaction partner, the loss of value of goods or assets related to the failed transaction, and the costs necessitated by entering into an alternative transaction. Nonseparability is affected by the need for responsiveness to the final consumer because meeting the needs of increasingly demanding consumers requires reliance on firms across many stages of a given value chain.

The ability to be responsive to the final consumer is affected by the strength of the customer need signal transmission received by firms in a given value chain. Signal transmission refers to how well the actual wants and desires of the final consumer are relayed throughout a particular value chain. Signal transmission varies according to the intensity of control in the transaction. The relationship between the strength of the signal transmission and intensity of control is discussed below.

Signal transmission and strategies based on a low intensity of control

In situations where strategies with a low intensity of control are deployed (e.g., spot market), final consumer signal transmission is likely to be limited unless the decision maker is selling directly to the end user (Robert L. Thompson 1997). Assets tend to be deployed to maximize the efficiency of a particular side of the transaction interface. For example, spot market arrangements result in the control of a limited subset of assets, relative to the assets employed in the entire value chain. This control over limited assets reduces the signal transmission and leads to an overall limited ability to be responsive to final consumers

Consider how a consumer's preferences for sweetness, crispness, and texture of pickles is transmitted through the value chain consisting of a retailer, distributor, processor, grower, and cucumber seed producer. How this signal is transmitted will depend on the form of governance structures employed throughout the value chain.

Traditional forms of vertical coordination strategy such as spot markets were often slow to react to changing consumer tastes. If for example, a customer wanted a sweeter pickle, the retailer would have to put in a request to its warehouse, the warehouse in turn would have to stock a variety of pickles. If sweeter pickles were not stocked in the warehouse, various venders would need to be contacted. These suppliers may or may not have sweeter pickles in stock. If the supplier did not have sweeter pickles in stock they would have to change a recipe to create them and depending on the nature of the pickle packer (i.e., do they pack fresh or out of a brine), the turn around time could be as long as a growing season or more. If the development of a sweeter pickle also included the selection of specific cucumber varieties, the process could be extended even longer. The entire process of giving the customer a sweeter pickle crosses numerous transaction interfaces, and the signal is easily lost or misinterpreted via strategies based on a low intensity of control because of limited information sharing characteristically of invisible hand coordination.

Signal transmission and strategies based on a high intensity of control

Due to the internal control nature across multiple stages of production under strategies such as formal cooperation and vertical integration, decision makers are able to be in closer contact with final consumers and their customers' signal transmission should be more transparent throughout a vertically integrated system. For example, the length of time required to provide a sweeter pickle could be reduced if the assets of the vertically integrated system are properly aligned. Therefore, the clarity and transparency of the signal transmission vary across the vertical coordination continuum.

Robert L. Thompson (1997) former Dean of the Purdue College of Agriculture and current President and Chief Executive Officer of the Winrock International Institute for Agricultural Development stated: "The increased reliance on contracting and vertical integration is being driven in many instances by the failure of the existing marketing institutions, or at least the previously existing marketing institutions, to transmit the quality characteristics of the food products demanded by today's consumers back to the farm gate." One interpretation of what Thompson is saying is that tighter forms of vertical coordination provide better signal transmission than traditional commodity marketing methods based on low intensity of control (e.g., spot markets).

Concluding remarks regarding final consumer responsiveness

Responsiveness is not merely an efficiency issue. It is an issue of effective information flow, correct asset alignment, and the capacity to perceive and respond to changing demands. There is increased reward for responding to increased specificity in consumer demand. At the same time product diversity is increasing. Conformance to specific quality standards may be more easily accomplished within a contract/ownership coordinated system than in the spot market. Additionally, market coordination of systems characterized by biological lags cannot respond to changing conditions as quickly as an integrated or contract coordinated system (Boehlje and Schrader 1994). When a vertically integrated system lines up exactly with a particular market segment and corresponding demand, Boehlje's assertions are plausible. However, the food system is changing so rapidly that lack of flexibility may not allow a firm the level of responsiveness required. In these cases strategic alliances or formal cooperation may be better suited to meeting the final consumers' needs.

When there is a need for high final consumer responsiveness and the appropriate resources are available, the output of the combined transaction is greater than the sum of the parts. However, the ability to be responsive can be limited when the appropriate resources are not available (when assets are misaligned).

2.4.1.3 Coordination errors and the catalyst

As argued earlier, as asset specificity and nonseparability increase, the costliness of a coordination error rises. The strategies of the coordination continuum are designed to provide varying intensities of control over the vertical transaction. Theoretically, the key link between the costliness of a coordination error and the vertical coordination strategy is that the intensity of control should match the costliness of an error. Specifically, as the costliness rises more intense control strategies should be used. When a decision maker senses that the costliness of a coordination error is unacceptable, she is really sensing that the current vertical coordination strategy is no longer aligned with the level of the costliness of a coordination error.

The next section on the first decision node expands on this notion of how strategies match with the costliness of a coordination error. For now, all that is necessary for the catalyst step is that the decision maker senses a problem.

2.4.2 Does an alternative reduce the costliness of a coordination error?

Having sensed a problem with the costliness of a coordination error, the decision maker moves to the first decision node. Here the decision maker must determine if an alternative vertical coordination strategy will reduce the costliness of a coordination error. Does an alternative provide a more optimal level of control over possible coordination errors than the current strategy (see figure 2.6)?

If there is a mismatch between the current strategy and costliness of a coordination error and this level of a mismatch can be lessened by the adoption of an alternative strategy, the decision process would then continue to the next decision node that asks if an

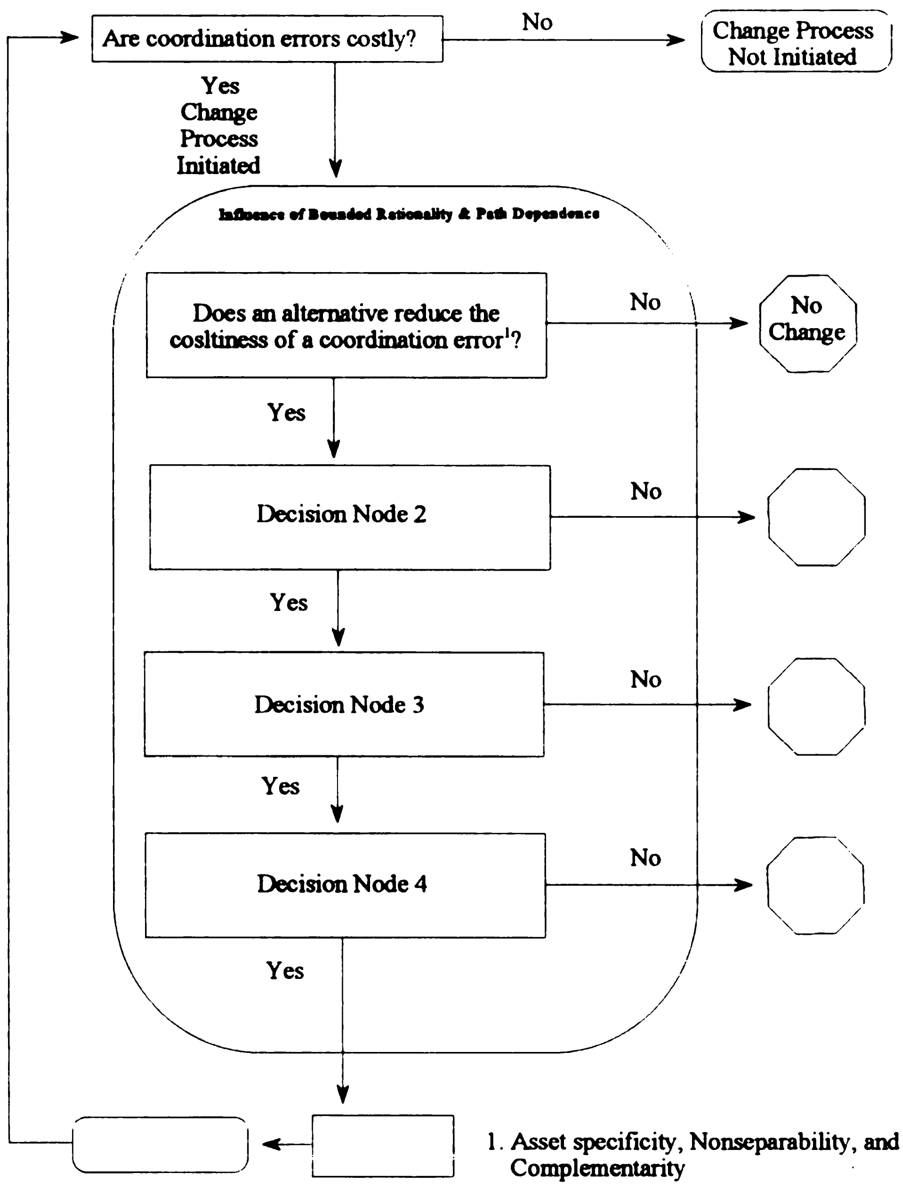

Figure 2.6 Decision Node 1 for Altering a Vertical Coordination Decision

alternative is programmable. If there is no mismatch between the current strategy and the level of the costliness of a coordination error[14], or when the adoption of an alternative strategy would not reduce the costliness of a coordination error, a decision maker will not change from the current vertical coordination strategy to an alternative.

2.4.2.1 *The relationship between the costliness of a coordination error and the theoretically optimal strategy*

How does the costliness of a coordination error (based on levels of asset specificity and nonseparability) map into the theoretically optimal strategies? The reader may recall the argument made in Chapter 1, that the five categories of governance structures (labeled as spot market, specification contracting, strategic alliance, formal cooperation, and vertical integration strategies) characterized the vertical coordination continuum. The underlying or latent variable of the continuum was defined as the intensity of control exercised at each strategy. It was postulated that external control via price and generic standards characteristic of spot markets, gives way to internal control via a centralized decision structure in vertical integration. Therefore, the higher the costliness of a coordination error, the greater the need for higher intensity of control in the vertical coordination strategy.

Earlier in this chapter the relationship between the costliness of a coordination error and the levels of asset specificity and nonseparability were presented. When asset specificity and nonseparability are low, the costliness of a coordination error is low and the intensity of control needed to manage the transaction is low. However, when the

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[14]When there is no mismatch between the current strategy and the level of costliness of a coordination error, adoption of an alternative strategy will only create a mismatch.

costliness of a coordination error is high, the intensity of control needed to manage the transaction is high. Based on theoretical and empirical work involving transaction cost theory, agency theory, and resource-based theory, low levels of asset specificity and nonseparability are associated with vertical coordination strategies which rely on a lower intensity of control such as spot market and specification contracting, while high levels of asset specificity and nonseparability are associated with vertical coordination strategies which rely on a higher intensity of control such as formal cooperation and vertical integration.

Based on a simple trichotomous measurement of asset specificity and nonseparability, Table 2.2 illustrates how the various possible combinations of asset specificity and nonseparability may map into theoretically optimal strategies.

Table 2.2 The Mapping of Nonseparability and Asset Specificity into Theoretically Optimal Strategies

Theoretically Optimal Strategy	**Spot Market**	**Specification Contracts**			**Strategic Alliance**		**Formal Cooperation**		**Vertical Integration**
Asset Specificity	Low	Low	Mod	High	Mod	Low	Mod	High	High
Nonseparability	Low	Mod	Low	Low	Mod	High	High	Mod	High

The combination of low asset specificity and low nonseparability result in a spot market as the theoretically optimal strategy, while the other end of the continuum (vertical integration) occurs when both asset specificity and nonseparability are high.[15] It is

[15]An argument could be made for classifying high asset specificity and high nonseparability as a type of formal cooperation close to vertical integration. The distinction

reasonable to assume that when asset specificity and separability are moderate or mixed across high and low, the theoretically optimal strategy is one lying in the middle of the continuum. Table 2.2 is an hypothesized mapping that will be used in the empirical work.

This mapping draws partially on Mahoney but relies heavily on the notion that vertical coordination exhibits gradual change of control intensity across the continuum. Only empirical testing can help validate this fundamental concept of strategy matching costliness of a coordination error.

2.4.2.2 Concluding remarks regarding whether or not an alternative strategy will lessen the mismatch between the current strategy and the costliness of a coordination error

The underlying variable of the vertical coordination continuum is the intensity of control exercised at each of the five strategy categories. When asset specificity and nonseparability are low, the costliness of a coordination error is low and the intensity of control needed to manage the transaction is low. However, when the costliness of a coordination error is high, the intensity of control needed to manage the transaction is high. Therefore the costliness of a coordination error can be managed by choosing the appropriate intensity of control. Changing the intensity of control is accomplished by altering the vertical coordination strategy.

If alternative exists which reduces the costliness of a coordination error, the decision maker will proceed to decision node two. If no alternative exists which reduces

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between categories was stated as being fuzzy in Chapter 1. Since the mismatch between the theoretically identified strategy and the alternative strategy is based on movement away from or towards the theoretically identified strategy and not an absolute difference, such refinements of strategy classification are not attempted here.

the costliness of a coordination error, the decision making process ends at decision node one and no change in vertical coordination strategy will take place.

2.4.3 Is an alternative programmable?

Reaching decision node two implies that the decision maker has found coordination errors to be costly, and an alternative has been identified which can reduce the costliness of a coordination error. Mere existence of an alternative vertical coordination strategy is not enough for adoption. The decision maker must now ascertain if effective management routines exist which might aid the decision maker in the adoption of a given alternative vertical coordination strategy. For example, the potato producer described in an earlier section who lost a major customer may be aware of alternative strategies for marketing potatoes, such as, a strategic alliance. Unless the potato producer has some idea (or knows where to look for ideas) on what entering into a strategic alliance entails, there is little chance she will adopt strategic alliance as an alternative vertical coordination strategy.

The framework postulates that the decision maker considers an alternative strategy to be programmable (effective management routines exist), an alternative vertical coordination strategy may be appropriate (see Figure 2.7). Again, further analysis must be undertaken before a new vertical coordination strategy should be implemented. The decision process would then proceed to the next decision node.

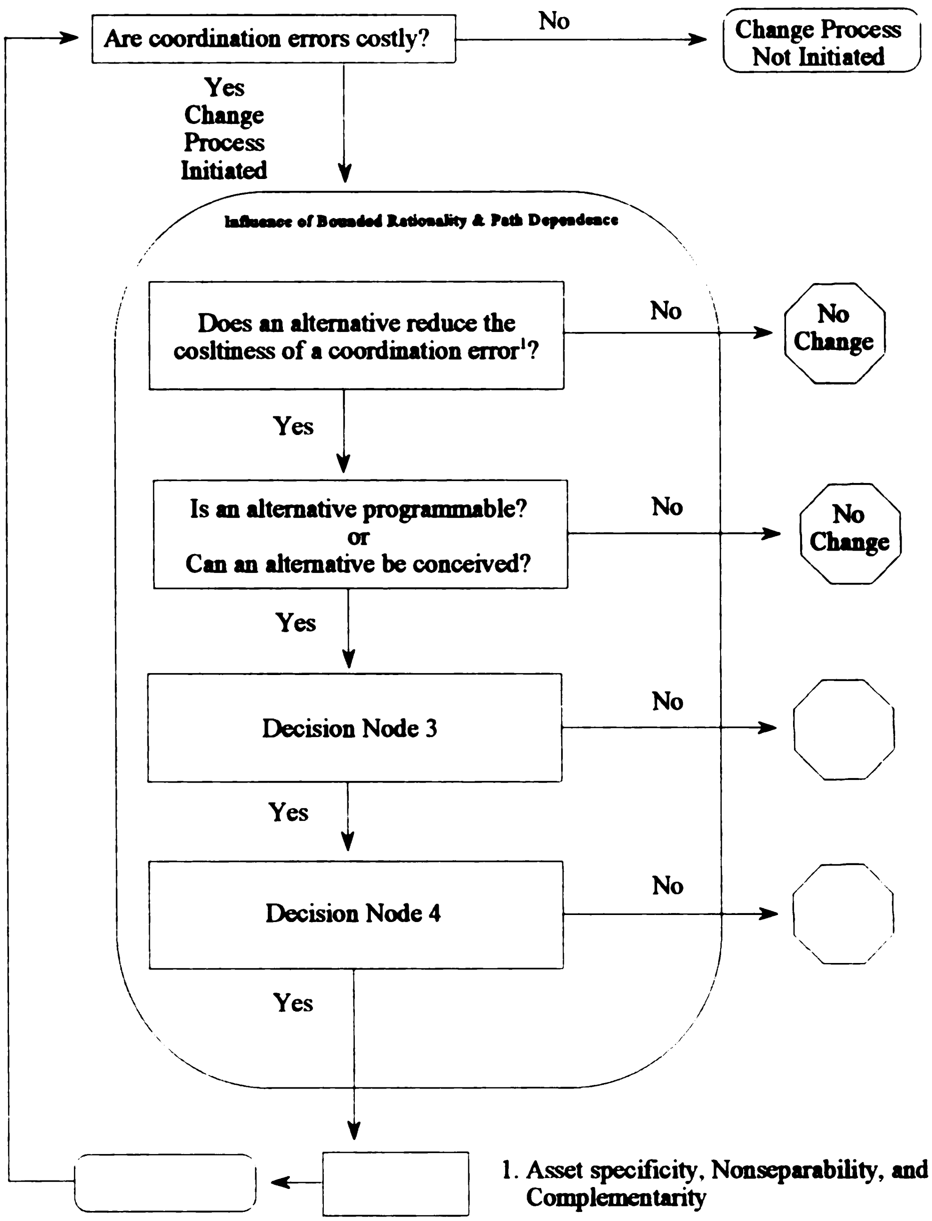

Figure 2.7 Decision Node 2 For Altering a Vertical Coordination Decision

2.4.3.1 *What leads to the programmability of alternative vertical coordination strategies?*

Mahoney defines high task programmability as a situation in which a product transformation process is well established and routine, leading to input measurement that is fairly certain and amenable to monitoring. This research places a different twist on programmability because programmability is related to more than just inputs into a process. An alternative vertical coordination strategy is deemed programmable in a broader sense if effective management routines (as opposed to product transformation routines) can be identified to carry out the tasks required at the transaction interface. Management routines must not only be established and routine, but they must be lead to successful adoption of the alternative. It is a road map for adopting an alternative vertical coordination strategy. The influence of bounded rationality and path dependence may affect programmability. Bounded rationality implies that decision makers have constraints on their cognitive capabilities. They intend to act rationally but may be hindered by their limited information processing and communication ability. The implication for programmable alternatives is that bounded rationality may prevent the decision maker from discovering or conceiving of alternative vertical coordination management routines.

Path dependence may result in limiting the number of potential alternative management routines possibly resulting in only one dominant vertical coordination management routine for a particular transaction interface. Path dependence may interact with bounded rationality to exclude otherwise viable management routines. The data collection procedures used in the empirical part of this research will be mindful of both bounded rationality and path dependence.

Just as with nonseparability, the traditional concept of task programmability has its origins in positive agency theory. Another related agency theory variable concerns knowledge of the transformation process or task programmability (Eisenhardt 1985; Ouchi 1979). Again this interpretation is based on input information in the context of principals and agents, and as thus is of limited use in this research.

According to Milgrom and Roberts, resource allocation is at the heart of the coordination problem. Resource allocation problems are best discussed according to design attributes. They describe coordination problems in which there is a priori information about how the parts of the decision must fit together (high task programmability). A design attribute is a general term describing a system in which the pieces must fit together in a predictable way (Milgrom and Roberts 1992). Mahoney's definition is concerned with the measurement of inputs, while Milgrom and Roberts posit that inputs must not only be measurable, but how these inputs go together has governance structure (strategy in this research) implications. Inputs in the form of effective management routines must exist (be programmable) if the decision maker is to adopt an alternative vertical coordination strategy.

There are times when effective management routines may not be readily apparent to the decision maker. In these situations the second part of the decision node becomes relevant (see Figure 2.7). Can an alternative management routine be conceived to carry out the task at the transaction interface? If the answer to this question is no, there is no reason to change from the current vertical coordination strategy. A decision maker who does not find alternative strategies to be programmable or effective management routines which could be conceived is an indication of: (1) no known existing examples of management routines for alternative vertical coordination strategies, and (2) theory was unable to suggest management routines that might be appropriate for alternative vertical coordination strategies.

2.4.3.2 Conclusions regarding the programmability of alternative vertical coordination strategies

An alternative vertical coordination strategy is considered programmable if effective management routines can be identified to carry out the task at the transaction interface. The programmability of an alternative is heavily influenced by bounded rationality and path dependence. Decision makers may have limited alternatives to choose from (i.e., due to path dependence) and may not even be cognitively aware of them (i.e., due to bounded rationality).

If an alternative vertical coordination strategy is found programmable, adoption of the alternative may be appropriate. The decision process would then proceed to the next decision node which tests implementability. If the alternative is deemed not to be programmable, then the decision maker needs to ascertain if the alternative can become programmable. If a way cannot be found to make an alternative programmable, then there is no reason to change from the current vertical coordination strategy.

2.4.4 Is an alternative implementable?

Arrival at decision node three occurs after errors in coordination have been deemed costly, alternative strategies have been identified for being able to reduce the costliness of a coordination error, and effective management routines exist or could be conceived which would aid in the adoption of an alternative strategy. The question before the decision maker becomes: is an alternative implementable or can the constraints associated with implementability be overcome?

If the answer to either question: "Is an alternative implementable?" or "Can the constraints of implementability be overcome?" is "YES" (see Figure 2.8) then an alternative vertical coordination strategy may be appropriate. Again, further analysis must be undertaken by proceeding to the next decision node. If the answer to both questions is no, then there is no reason for the decision maker to change from the current vertical coordination strategy.

2.4.4.1 What leads to the implementability of alternative vertical coordination strategies?

An alternative is considered implementable if all of the following components of implementability are present: (1) the institutional acceptability of the proposed vertical coordination strategy is not constraining, (2) access or amount of necessary capital was within the firm's abilities, (3) compatibility with available partners matched with the alternative strategy, and (4) the primary coordination competence of the decision maker fit the alternative vertical coordination strategy. The absence of any one of the four implementation components may be strong enough to prevent a change in vertical coordination strategy.

These four components of implementability individually arise from some basic notions of what is needed to make an alternative work. For example, is the alternative legal (institutional acceptability)? Does enough capital exist to adopt the alternative? Does a realistic partner exist? Does the decision maker have the skills to carry out the

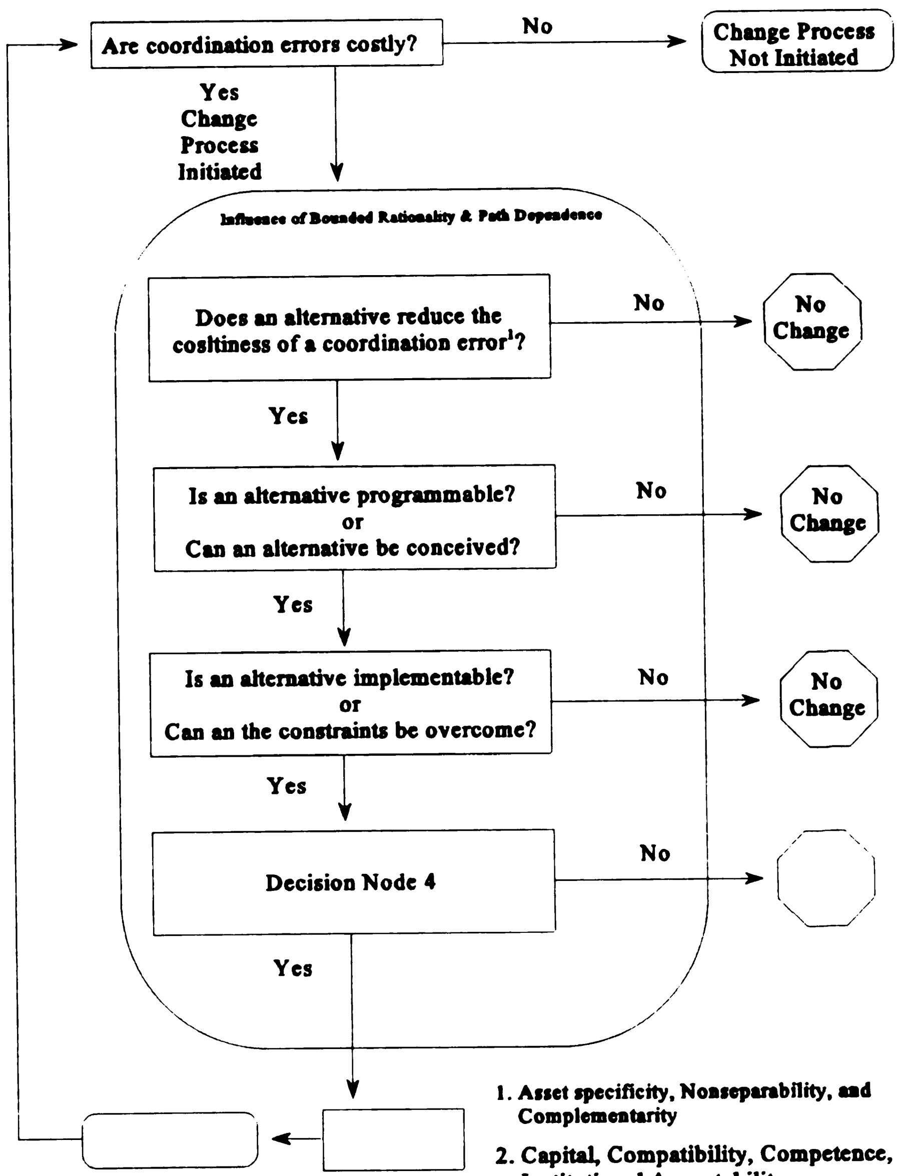

Figure 2.8 Decision Node 3 For Altering a Vertical Coordination Decision

alternative strategy? These four questions see exhaustive. The empirical inquiry will help test whether or not they are exhaustive.

2.4.4.1.1 Institutional acceptability

Institutions reduce uncertainty by providing structure to everyday life. In fact, institutions guide human interaction. In the jargon of the institutional economist, institutions define and limit the set of choices of individuals (North 1990: p. 3). Institutions may be formal or informal, where formal constraints are rules that human beings create and informal constraints are best described as codes or conventions of behavior. Decision making takes place within the context of institutional constraints, and they are therefore an important component of the decision process for altering a vertical coordination strategy.

Nobel Prize winning economist Douglass C. North in his 1990 book *Institutions, Institutional Change and Economic Performance* defines institutional constraints as follows:

> "Institutional constraints include both what individuals are prohibited from doing and, sometimes, under what conditions some individuals are permitted to undertake certain activities. As defined here, they therefore are the framework within which human interaction takes place, They are perfectly analogous to the rules of the game in a competitive team sport. That is, they consist of formal written rules as well as typically unwritten codes of conduct that underlie and supplement formal rules, such as not deliberately injuring a key player on the opposing team, and as this analogy would imply, the rules and informal codes are sometimes violated and punishment is enacted. Therefore, an essential part of the functioning of institutions is the costliness of ascertaining violations and the severity of punishment." p. 4

The above definition of institutional constraints is similar to what this research defines as institutional acceptability. The effects of institutional acceptability are common in agriculture. For example, two potato growers may each be renting one-half of the available land from the same landowner. Every year the two potato growers are each allowed to rent one half of this land. In this case, there may be a formal or informal agreement between the landowner and the potato growers stating that each renter will receive one half of the rented land. This form of institutional acceptability reduces uncertainty regarding the grower's crop rotation schedules.

How organizations come into existence and how they evolve are fundamentally influenced by institutional acceptability. North (1990: p. 12) cites Ronald Coase for saying a number of fundamentally important things in both his 1960 essay "The Problem of Social Cost," and his "The Nature of the Firm" (1937). According to North, one of the most important messages of Coase's work is that when transacting is costly, institutions matter. This research postulates that institutional acceptability, whether formal or informal, is present in all decision making and may even be the defining factor in choosing a particular vertical coordination strategy.

North makes a distinction between institutions and organizations. While organizations like institutions provide a structure to human interaction, the rules must be differentiated from the players. Rules define the way the game is played, and the objective of the team (decision maker's organization) within that set of rules is to win the game by a combination of skills, strategy, and coordination. Modeling the strategies and the skills of the team as it develops is a separate process from modeling the creation, evolution, and consequences of the rules (1990: p. 5). This research accepts institutions as a given that shapes the way decision makers make vertical coordination decisions. The emphasis in this research will be on the player (e.g., understanding the strategies and skills of the vertical coordination decision process), and not on the rules (e.g., the evolution of institutions).

Building a theory of the decision process for altering a vertical coordination strategy on the foundation of individual choices is essential because a logically consistent, potentially testable set of hypotheses must include components of a theory of human behavior. Institutions are a creation of human beings, and as such, they evolve and are altered by human beings. The proposed framework incorporates various economic and behavioral theories in an attempt to better understand the vertical coordination decision. Institutional acceptability affects other factors which contribute to the choice of a vertical coordination strategy. For example, the major role of institutions in a society is to reduce uncertainty (North 1990: p. 6).

Governmental policies may create structural impediments or even facilitate the operation of various vertical coordination strategies (Rai, et al. 1996 p. 143). Enforcement of antitrust laws in the U.S. serve as a useful example for illustrating institutional acceptability. Many researchers in agricultural economics, economics, and business strategy have documented increased merger activity in the U.S. since the early 1980's. Invariably, these authors point to the Regan administration's relaxed attitude toward enforcement of potential antitrust violations (i.e., increased institutional acceptability) as a major influence in the increased merger activity of the 1980's (Connor and Geitham 1988).

Institutional acceptability must be discussed in the context of a specific alternative strategy. For example, one form of institutional acceptability is antitrust law. These laws may prevent the acquisition of one company by another in cases leading to vertical integration and monopoly power. These same laws may not apply to other forms of coordination such as strategic alliance and specification contracting.

In this framework, institutional acceptability is one of the four components of implementability. Institutional acceptability or lack of, may be strong enough by itself or in combination with the other three implementability components to prevent adoption of an alternative strategy.

2.4.4.1.2 Capital: access and level

The amount of, or access to, capital that a decision maker has can directly affect choice of vertical coordination strategy. Consider the average Michigan celery producer who has a limited amount of capital. It is not realistic to assume that average celery producer in Michigan would have the capital needed to construct a celery processing plant in order to give a food company the quantity and required consistency of sliced celery to be used in oriental entrees. However, it is quite possible that a group of average-sized celery producers could form a cooperative, and as a result, could raise the capital needed to build a celery processing plant. This example illustrates how the amount of capital needed may restrict choice of vertical coordination strategy.

Consider the same celery grower who goes to his local lender each Spring to obtain capital (i.e., an operating loan) to plant his/her crop. If the celery grower's financial position is in questionable shape, it is quite possible that the lender may require the celery grower to obtain a marketing contract with a celery processor before granting an operating loan. This is another example of access to capital being restricted and its resulting influence on choice of vertical coordination strategy.

As with institutional acceptability, the amount of, or access to capital may be strong enough by itself or in combination with the other three implementability components to prevent adoption of an alternative strategy.

2.4.4.1.3 Compatibility with available partners

The importance of reducing the costliness of a coordination error was established earlier in this chapter. The primary mechanism used to reduce the costliness of a coordination error is a change in vertical coordination strategy. The need for compatibility between partners varies across the vertical coordination continuum but it is especially strong in the middle strategies of specification contract, strategic alliance, and formal cooperation. If compatible partners cannot be found, these strategies cannot be implemented successfully.

Compatibility can be thought of as having two distinct parts in this research: (1) cultural compatibility, and (2) strategic compatibility. Each of the two types of compatibility will be discussed in the following sections, as well as the role of trust and other factors which can affect compatibility.

Cultural compatibility

Do potential partners share a common culture, the same values, philosophies, and conflict resolution approaches? When values are shared, trust is an easier thing to create in an ongoing relationship and control of the transaction is better assumed. Cultural compatibility may be enhanced because of ethnic background, geographic location, industry affiliation, etc. Every company has a unique organizational culture. Each has its own business philosophy and principles, its own way of approaching problems and making decisions, and its own embedded patterns of "how we do things around here." In other words, its own ingrained beliefs, behaviors and thought patterns, business practices, and personality (Thompson and Strickland 1995: p. 292).

Partners often have different goals, making resolution of conflicting interests central to long-term success of the relationship. Thus harmony and partnership are even more difficult to achieve when partners do not often share a common environment or domain (Borys and Jemison 1989: p. 237; Kumar 1996: p. 98) That is, they lack cultural compatibility. From a cultural compatibility perspective, the power of vertical arrangements to provide stability is rooted in shared norms and values (Schein 1985). The underlying source of cultural cohesion may result from members' expectations that they will be dealt with fairly (Wilkins and Ouchi 1983). This implies that values need not be shared, but they must be mutually respected. The capacity to respect others' (differing) values are sufficient for cultural compatibility.

Strategic compatibility

The ability to approach day-to-day business from the same strategic point of view defines strategic compatibility. Do potential partners embrace the same strategic approach (e.g., quality driven companies versus a low cost provider)? Does a firm's internal organization complement its potential partners? For example, a cost-leader producer would most likely want to partner with a cost-leader processor. Just as a superior-quality producer would prefer a quality-focused processor.

De Graaf and De Vlieger present a strategy component as part of the internal context of a firm. This is based on the belief that the objective of vertical relationships can differ based on the choice of generic firm strategy. For example, for a firm with a cost leadership strategy, the lowest price is an important goal of a vertical relationship. But a firm with a quality/features (differentiation) strategy will seek to maximize its value as an important objective of a vertical relation (Lassar and Keer 1996). Firms in the same industry that utilize different generic strategies find it difficult to understand each other's actions in the marketplace, which makes it exceedingly difficult to engage in some forms of contracting, strategic alliances, or formal cooperative arrangements.

De Graaf and De Vlieger (1997: p. 3) also present a model of the decision making process of vertical coordination where they discuss the external context of the organization, which includes a social/institutional context called interdependence. That is, do their strengths and weaknesses compensate for each other allowing the partnership to be stronger than the individual entities?

Michael Porter (1985) describes a firm's value chain which shows the linked set of activities and functions a company performs internally. These functions include: purchasing and inbound logistics, operations, outbound logistics, sales and marketing, service, and support activities such as R&D and human resources. A firm may be weak when it comes to outbound logistics and strong in sales and marketing. A potential partner would have high strategic compatibility if they possessed strong outbound logistics and weak sales and marketing. Implementability is likely when strategic compatibility is present between partners.

The role of trust in compatibility

The presence of trust expands the choice set of vertical coordination strategies available to a decision maker, which in turn, offers more opportunities to increase implementability. Trust is nurtured through cultural and strategic compatibility. Trust is "generated because of personal relations that arise in the course of economic transactions" (Chiles and McMackin 1996: p. 86). The conditions that generate trust may be viewed through the interpretive lens of social norms. In this case, "global trust in generalized others" (Butler 1991: p. 643) is created as a result of social norms, such as norms of reciprocity (Gouldner 1960), norms of obligation and cooperation (Bradach and Eccles 1989), and norms of fairness (Kahneman, Knetsch, and Thaler 1986). Such social norms generate shared expectations among people at various societal levels, including local and regional culture, and industry sectors by way of standard business practices and trade associations (Chiles and McMackin 1996: p. 86). It is in the honoring of moral obligations inherent in these social norms that generates trust, which in turn, constrains opportunistic behavior.

The presence of trust decreases negotiating, drafting, and monitoring costs. That is, trust reduces transaction costs. Transactions involving sufficiently large investments in transaction specific assets that would conventionally be assigned to a hierarchical governance structure in the absence of trust may be assigned to a hybrid governance structure in the presence of trust (Chiles and McMackin 1996: p. 89). This directly supports the idea that the level of compatibility with available partners varies across vertical integration, strategic alliances, and formal cooperative arrangements.

Trust involves among other things, dependability. That is, can partners be counted on to do the "right" thing? A distinguishing feature of trusting relationships is the ability of partners to make a leap of faith. They believe that each is interested in the other's welfare and that neither will act without first considering the action's impact on the other (Kumar 1996: p. 95).

Amanor-Boadu and Martin (1992) and Martin et al., (1993) present an alternative model for predicting organizational form, where they posit that low trust, combined with low competence (which they define as the ability to do things that build trust) is associated with spot markets and vertical integration. Areas requiring high trust fall in the middle of the continuum (i.e., strategic alliances). This approach to trust is consistent with the proposed framework's treatment of trust.

Mutually assured destruction and compatibility

Mutually assured destruction offers another reason for firms to engage in non-spot market vertical coordination strategies for achieving higher levels of implementability. The concept of mutually assured destruction was popularized during the cold war between the former Soviet Union and the United States. During the cold war both the former Soviet Union and the United States possessed enough military firepower to destroy each other. This balance of power helped to maintain peace, even if the peace was tenuous at times. In some respects, this balance of western and eastern power helped to stabilize the economies of both hemispheres.

The Michigan Livestock Exchange (a producer-based livestock marketing cooperative) and Thorn Apple Valley (a Midwest livestock processor) are currently involved in a strategic alliance where Michigan Livestock Exchange is the sole supplier of hogs to Thorn Apple Valley. In exchange for a constant supply of hogs, the processor has agreed to price the hogs through contracts. The strategic alliance has received a fair amount of publicity and praise in the agricultural community. What is less well known is that it took years of spot market exchange and constant negotiation, between Michigan Livestock Exchange and Thorn Apple Valley before the parties agreed to form the current strategic alliance. At one point, the animosity between the parties reached a point where, for six months Thorn Apple Valley refused to buy from Michigan Livestock Exchange and Michigan Livestock Exchange refused to sell to Thorn Apple Valley. Eventually, both sides came to the same conclusion that they could gain more by establishing a mutually beneficial relationship. The fact is that compatibility may develop out of forces such as mutually assured destruction, but in order for relationships which require high levels of compatibility to survive long-term, cultural and strategic compatibility, as well as trust must be present.

Concluding remarks regarding compatibility

Compatibility with available partners is comprised of the interaction between cultural compatibility, strategic compatibility, and trust. This research posits that the relationship between compatibility and organizational form takes the shape of a concave function. The need for compatibility is the lowest on either end (see Figure 2.9) of the continuum (spot markets and vertical integration), while all three components of compatibility must be the highest for strategic alliances to be successful in the long-term.

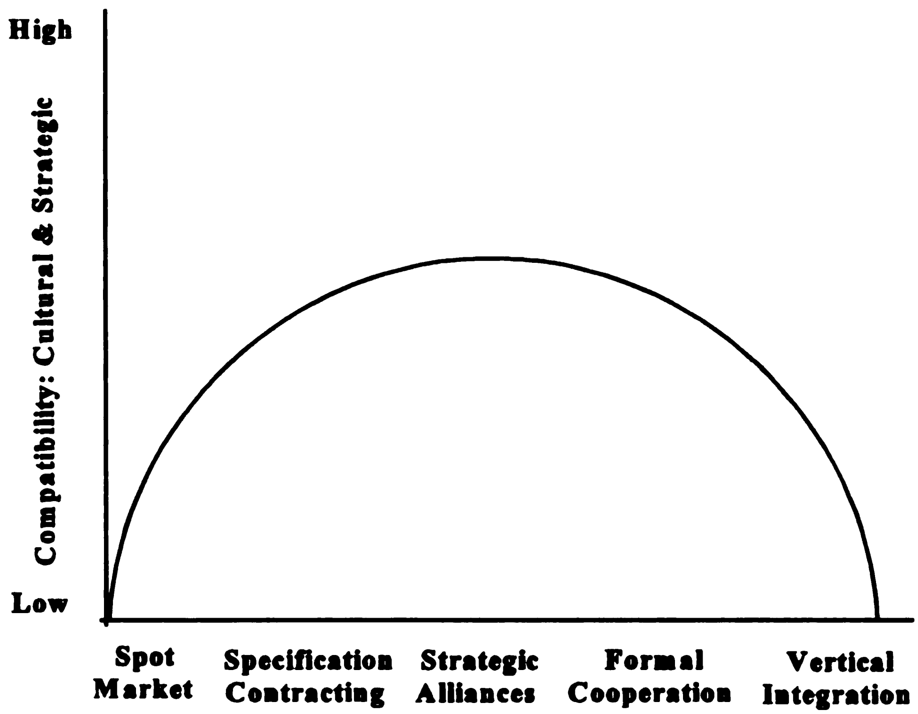

Figure 2.9 The Relationship Between Compatibility and Vertical Coordination Strategy

Trust is a key factor in developing long-term successful strategic alliances. If there are no compatible partners available, the decision maker is left with two choices: (1) going it alone in the spot market, or (2) vertically integrating, in effect allowing the decision maker to create compatibility as he or she sees fit.

2.4.4.1.4 Coordination competence of the decision maker

Different vertical coordination strategies are likely to require different skills or proficiencies on the part of the decision maker. Coordination competence is defined in this research as the ability and willingness of decision makers to manage a particular vertical coordination strategy. Coordination competence resides at the nexus between the firm and its potential partners along the continuum. For example, decision makers who are skilled at using the spot market can be characterized as "horse-traders" or people who enjoy the art of buying and selling, as well as the uncertainty associated with deal making on the spot market. If a firm has learned to effectively "horse-trade" in the open market, this very managerial competence may protect it from otherwise excessive opportunism and reduce its desire to partner. In turn, successful partnering depends on its own set of skills, such as, negotiating and monitoring under contracts, collective problem-solving and mutually shared goals with strategic alliances, and the diplomatic skills required to enter formal cooperative arrangements, while maintaining separate ownership of the original business. Vertical integration demands yet another set of managerial competencies that allow effective management over a broad span of control. Without such competence, vertically integrated firms could quickly cease to be competitive. Table 2.3 presents the relationship of these various coordination competencies to the vertical coordination continuum.

Table 2.3 The Relationship of Coordination Competencies to Vertical Coordination Strategy

Strategy / Skills	Spot Market	Specification Contracting	Strategic Alliances	Formal Cooperation	Vertical Integration
Coordination Competence	Horse Trader	Negotiator Monitor	Partner	Diplomat	Controller

Implementability depends upon the decision maker having the required coordination skills. For example, many produce sellers have lamented the fact that most of the younger produce buyers today place little value on “horse-trading.” The ability to provide resourceful sales solutions used to distinguish successful from unsuccessful sellers. Most of today’s buyers seek a mix of coordination competencies based on the seller being a “negotiator-monitor,” a “partner,” or a “diplomat.” Thus implementability of traditional spot market selling strategy has declined, while implementability of the middle continuum strategies has improved.

Concluding remarks regarding coordination competence

The previous discussion of ability and willingness alluded to decision maker traits that may be described as preferences. For example, a decision maker may just prefer to be a horse-trader rather than a negotiator. One might argue that these described coordination characteristics are preferences, not competencies. This research finds value in allowing the characteristics to be both competencies and preferences since people generally prefer to do things they are competent at.

In summary, coordination competence is comprised of scope as well as external coordination skills. The coordination competence that a firm has, or is willing to develop, is a potentially important determinant of strategy selection since it characterizes the decision maker's ability to implement alternative vertical coordination strategies.

2.4.4.2 Concluding remarks regarding the implementability of alternative vertical coordination strategies

Just as programmability is influenced by bounded rationality and path dependence, so is implementability. Decision makers intending to act rationally may be hindered by their limited information processing and communication ability. The implication for implementable alternatives is that bounded rationality may prevent the decision maker from discovering or overcoming constraints caused by capital, compatibility, competence, and institutional acceptability issues. For example, limited information about a potential partner may lead the decision maker to believe that compatibility is low, when in actuality, it may be high. If a decision maker is known for preferring a narrow scope versus broad scope of business, bounded rationality may reinforce the decision maker's inclination to maintain narrow scope of business.

The effects of path dependence may be present in each component of implementability, namely: institutional acceptability; access to, and amount of, capital; compatibility; and competence. Path dependence often leads to the entrenchment of institutions, and therefore institutional acceptability. A government may favor spot market forms of exchange over other vertical coordination strategies, such as, mergers as a result of antitrust laws which have been on the books for years, due in part to path dependence. Agricultural researchers often hear farmers who claim that they could never work with so and so because they have never been able to in the past. Finally, a decision maker who has spent years controlling as many aspects of the business as possible, may find it hard to change his/her controlling ways to another more external coordination competence.

In the end, this research considers four categories of factors which affect implementability including capital, compatibility, competence, and institutional acceptability. If an alternative is implementable, the decision maker will proceed to the next decision node regarding the acceptability of the risk/return tradeoff. If the alternative is not implementable, the decision maker will attempt to see if the constraints that limit the alternative's implementability can be overcome. If these constraints can be overcome, the decision maker will proceed to the next decision node, if not, the decision maker has no reason to change from their current vertical coordination strategy.

2.4.5 Is the risk/return tradeoff acceptable?

By this stage of the decision process the decision maker has determined that a coordination error is costly, an alternative could reduce this costliness, effective management routines exist which aid in the adoption of the alternative, and the alternative is implementable based on issues of capital, compatibility, competence, and institutional acceptability. Now the task becomes assessing the acceptability of the risk/return tradeoff associated with the alternative vertical coordination strategy being considered.

If the risk/return tradeoff of the alternative is acceptable or the tradeoff can be improved, then the adoption of an alternative vertical coordination strategy is appropriate (see Figure 2.10). However, the decision process will cease if the risk/return tradeoff of the alternative strategy is not acceptable or ways cannot be found to improve the tradeoff (e.g., reducing the risk, increasing the returns, or a combination of the two).

2.4.5.1 What leads to the risk/return tradeoff of alternative vertical coordination strategies being acceptable?

An alternative's risk/return tradeoff is composed of two parts: (1) the role of expected profit in the vertical coordination decision, and (2) risk/uncertainty in the transaction. These two components interact with the decision maker's aversion to risk and uncertainty and profit maximizing goals to create the risk/return tradeoff concept used in this framework.

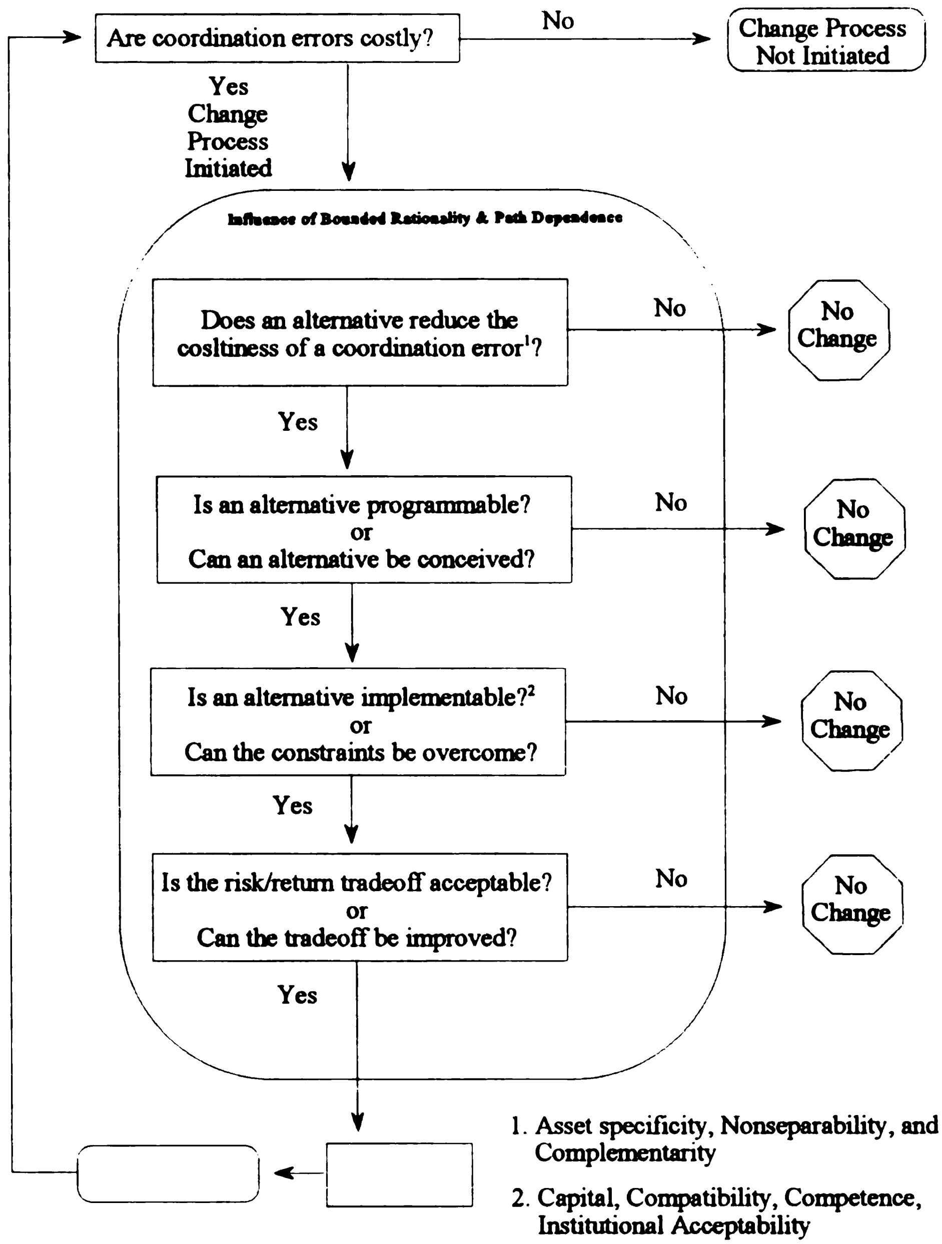

Figure 2.10 Decision Node 4 For Altering a Vertical Coordination Decision

2.4.5.1.1 <u>The role of anticipated profit in the vertical coordination decision making</u>

There is a vast gap between the relatively clean, precise, and simple world of neoclassical economics and game theory and the complex, imprecise, and fumbling way by which human beings have gone about structuring human interaction (North 1990: p. 15). Game theoretic models, like neoclassical models, assume wealth maximizing players. But as some experimental economics literature demonstrates, human behavior is clearly more complicated than can be encompassed in such a simple behavioral assumption. The need for an adaptable framework, and the inability of a static model to capture the decision process for altering a vertical coordination strategy supports the point made by North. This research seeks to narrow the gap between the clean, precise models of economics and the messy and imprecise way humans interact.

Any framework that seeks to explain choices of vertical coordination strategy from a decision-maker's perspective must take into account that decision makers are motivated, in part, by a desire to increase profits. For many decision makers, the profit motive is an explicit rationale for choice of organizational form. In transaction cost analysis this is presented in the form of cost minimization. The resource-based theory of the firm is more explicit regarding the role of profits. Firms make specific choices regarding organizational form that lead to competitive advantage and superior returns. The potential for profit at each stage of the continuum will depend on many factors, including the factors of the framework already presented and the choice of vertical coordination strategy and its corresponding profit potential will vary across firms and industries.

2.4.5.1.2 The role of risk/uncertainty in the vertical coordination decision

The task of defining risk has been fraught with controversy and confusion (Fischhoff, et al. 1990). Although decision theory suggests that risk is "The variance of the probability distribution of possible gains and losses associated with a particular alternative" (March and Shapira 1987), organizational researchers have suggested that this is a poor description of how managers view risk (MacCrimmon and Wehrung 1986). The difference between risk and uncertainty is perhaps subtle, but nonetheless important to this research. As Orbell (1993) put it:

> "A decision maker confronts risk when he or she can attach probabilities to alternative states of the world with confidence; from a fair pack of playing cards, for example, a gambler can be confident that there is a 1 in 52 chance of drawing the ace of hearts. A decision maker confronts uncertainty, however, when there is an unknown number of cards and (or) an unknown number of aces of hearts in the deck. Under uncertainty, not only can one still lose, but one does not know the odds." p. 130

Both risk and uncertainty are incorporated in the risk/return tradeoff. In what follows, risk aversion, neutrality, and risk seeking behavior is discussed along with uncertainty in the transaction.

Risk: aversion, neutrality, and seeking behavior

Inability to tolerate the risks of open market exchange could lead a firm to consider more managed coordination with its emphasis on mutual as opposed to conflicting interests. Martin et al. used risk as a key variable in their scheme. However, a producer can manage price risk through futures contracts that do not require any form of vertical linkage with others directly in the marketing chain. To the extent that such individual strategies for managing market risk exist, the incentives for managed coordination are diminished. The more relevant risk issue to the coordination decision may be the residual demand/supply risk that the firm cannot manage through any stand-alone means and its corresponding tradeoff with profits or returns. The risk of market access over time may be one of these types of risk. Being part of a strategic alliance, for example, may improve the risk/return tradeoff significantly.

Transaction cost analysis is based on the behavioral assumption of risk neutrality (Williamson 1975). Decision-makers are assumed to be "indifferent between a prospect of uncertain profits and a certain profit, provided the expected average of the prospective fluctuating profits is equal to the certain profit" (Aoki 1984: p. 15). Chiles and McMackin (1996) and De Graaf and De Vlieger, (1997: p. 5) argue in their research that incorporating a range of risk preferences, including risk aversion, risk neutrality, and risk seeking into Williamson's transaction cost model, can help to resolve many apparent contradictions encountered in earlier empirical work. For example, empirical evidence has shown that firms can choose and sustain different governance forms based on the same levels of asset specificity, bounded rationality, and opportunism (Robins 1987: p. 81). This research follows the lead of Robins and builds upon transaction cost theory by relaxing the risk neutrality assumption and allowing for relative risk aversion, risk neutrality, and risk seeking behavior.

Chiles and McMackin (1996: p. 82-91) use a series of graphs to show how the introduction of risk increases the switch over level of asset specificity from market to hierarchy. Chiles and McMackin's analysis suggest that risk seeking behavior creates a much wider range of asset specificity under which firms are likely to choose market governance forms over hierarchical forms. At the same time risk averse behavior allows a much narrower range of asset specificity under which firms are likely to choose market governance forms over hierarchical forms. Risk neutral behavior falls somewhere in between.

Uncertainty in the transaction

Barkema and Drabenstott present a list of key factors in the firm's coordination decision including the role of uncertainty (price, quantity, quality, and timeliness). Based on of the work of Williamson (1975) and Barkema and Drabenstott (1995: p. 489), an increase in uncertainty favors internal coordination or vertical integration. It is the lack of tolerance for residual risk/uncertainty that leads firms to seek coordination strategies requiring more managed control (e.g., characteristic of strategic alliances, formal cooperation, and vertical integration).

Frank and Henderson (1992) conducted an empirical study looking at transaction costs in U.S. food industries. Among other things they found empirical support for increases in demand and supply uncertainty leading to increased use of nonmarket coordination methods. This seems to support the idea of reduced tolerance for residual risk and uncertainty leading to increased use of "managed" vertical coordination strategies.

Uncertainty may take on many forms and the various types of uncertainty (volume, measurement, quality, technological, price, demand, etc.) may have different impacts on the choice of coordination strategy. Even an assessment of the effects of a particular type of uncertainty on the choice of governance structure can be problematic. For example, the dynamic effect of demand uncertainty on the choice of vertical financial owner or vertical contract is theoretically indeterminate (Mahoney 1992: p. 563). Mahoney lists the findings of several studies as they relate to choice of governance structure and uncertainty. While uncertainty, by itself, may be theoretically indeterminate, incorporation of uncertainty into the proposed framework may serve to be fruitful, given the in-depth case study approach that will be used.

Mahoney has apparently reconsidered his 1992 position regarding the incorporation of uncertainty in models used to predict organizational form. In a recent paper presented by Mahoney during the 1997 AAEA post conference learning workshop in Toronto, Mahoney stated that at least four types of uncertainty may have impacts on the make-or-buy decision. These include demand (volume), technological, output measurement (incorporated in this research as nonseparability), and input measurement (task programmability defined in this research is a derivative of input measurement uncertainty). One of these four, demand and technological uncertainty are relevant to the discussion here. Higher demand uncertainty makes contracting more difficult (under conditions of asset specificity) and favors vertical financial ownership. Firms often face environmental uncertainty in the form of demand (volume) uncertainty. To the extent that volatile sales are anticipated, fluctuations in demand will not necessitate vertical financial ownership, since a contingent claims contract will suffice. The uncertain timing of obsolescence of a technology can lead a firm not to choose a highly specific technology and hence vertical financial ownership is less likely (Mahoney and Lajili 1997: p. 17-18).

Early transaction cost literature (Williamson 1975) did not distinguish between types of uncertainty. In more recent transaction cost and strategic management literature, the construct of uncertainty has been broken into various parts (Williamson 1985). In a recent article, Sutcliffe and Zaheer divide uncertainty into three distinct components: primary, competitive, and supplier uncertainty (1998: p. 3). This research adopts the following terminology to distinguish between primary uncertainty, competitive uncertainty and potential partner (supplier) uncertainty (Figure 2.11 illustrates the relationship between primary, competitive, and potential partner uncertainty). Each of these components is discussed in what follows.

Primary uncertainty

Primary uncertainty reflects the uncertainty arising from exogenous forces, such as natural events, from changes in preferences, as well as regulatory changes, such as those involving standards or tariffs. This definition was derived from the work of Koopmans (1957) and Williamson (1985). Sutcliffe and Zaheer (1998: p. 3) argue that primary uncertainty subsumes technological uncertainty, or the uncertainty arising from changes in technology due to new inventions or discoveries.

Firms have to adapt to changes in the environment. However, as the number of possible changes increases, the number of possible unforeseen contingencies also increases. Bounded rationality is likely to affect how a decision maker could deal with primary uncertainty in this context. Under conditions of increased primary uncertainty, actors will read and react to the same information in the broader environment differently, leading to the possibility of sub-optimized outcomes and increased costs. Firms in this situation are more likely to choose a hierarchical form of coordination, or at least to prefer to move away from market-oriented forms of vertical coordination.

Sutcliffe and Zaheer (1998: p. 4-5) say that increases in primary uncertainty does not always lead to shifts away from spot markets toward vertical coordination. In fact, uncertainty in technological conditions (i.e., when technological change is high, coupled with strong competition), is likely to discourage vertical integration because of the expected lowered profits caused by this uncertainty and high competition.

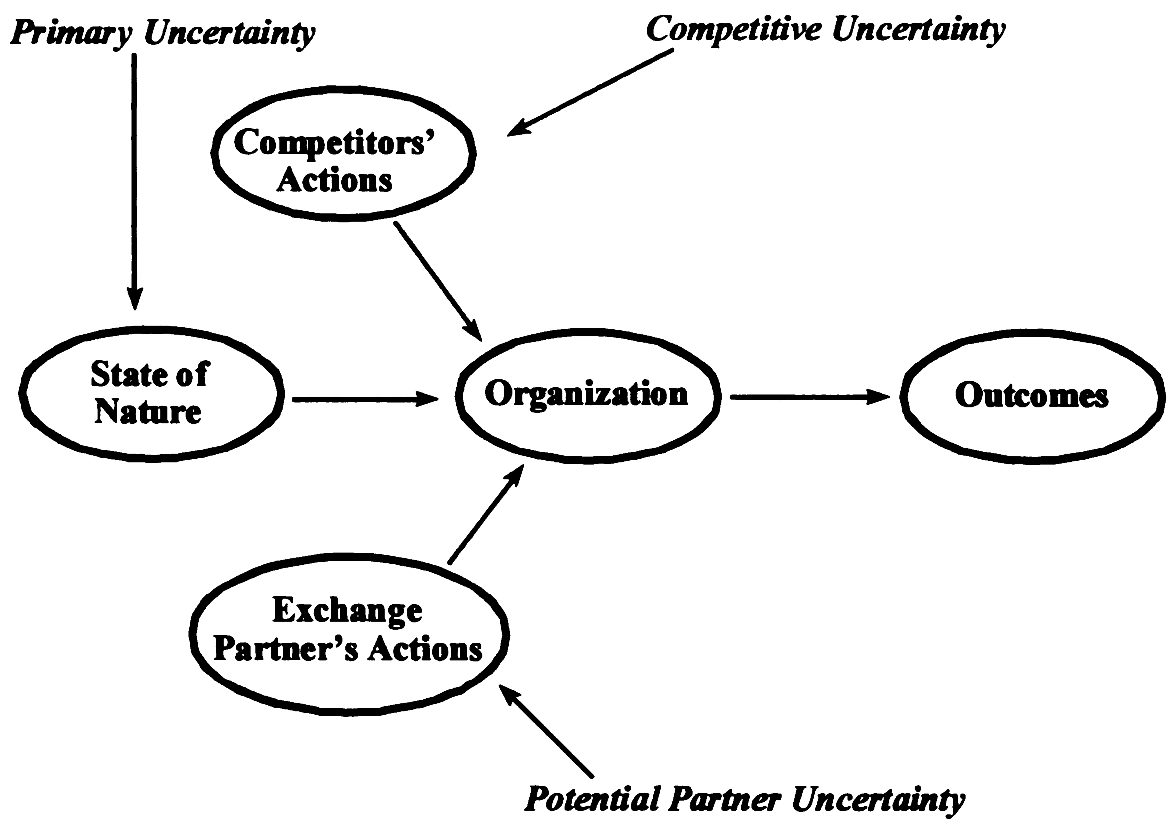

Figure 2.11 Sources of Uncertainty

Source: Adapted from Sutcliffe and Zaheer. Uncertainty in the Transaction Environment: An Empirical Test, *Strategic Management Journal*, vol 19, no. 1 1998: p. 1-23.

Competitive uncertainty

Competitive uncertainty (secondary uncertainty as described by Koopmans and Williamson) is defined as uncertainty about the actions of other economic agents, generally speaking. This approach fits well with the strategic management literature which views the actions of competitors and others, as well as the macro environment, as important for strategic analysis (Porter 1980).

Williamson (1985) describes both primary and secondary (competitive) uncertainty as “innocent” and “non-strategic” forms of uncertainty and distinguishes them from behavioral uncertainty (defined as potential partner uncertainty in this research), the deliberate non disclosure of information or the strategic misrepresentation of information by economic agents.

Sutcliffe and Zaheer (1998), and this research posits that competitive uncertainty arising from the actions of competitors or potential competitors, may be either "innocent" or "strategic" in nature. For example, moves by potential new entrants, or firms making substitutes, beyond those of existing competitors in an industry may have a major influence on a firm's vertical coordination strategy decision. The uncertainty caused by potential or existing competitors may be deliberate, stemming from strategic motives (i.e., to be the first in the market with a faster microprocessor). On the other hand, competitive uncertainty may arise innocently from a lack of competitor intelligence or awareness about the prospective actions of competitor firms. This researcher remembers being in business for himself and all the foolish pricing tactics he used to gain new business early in the company's history. These pricing tactics surely raised the competitive uncertainty and anxiety of competing firms in the marketplace.

Potential partner uncertainty

Potential partner uncertainty (supplier uncertainty as defined by Sutcliffe and Zaheer) is the behavioral uncertainty arising from the strategic actions of exchange partners or potential exchange partner firms (Sutcliffe and Zeheer 1998: p. 4). This research emphasizes the behavioral uncertainty from both current and potential exchange partners. This is a departure from Sutcliffe and Zaheer who limit the definition to current up or downstream exchange partners. Earlier discussions regarding compatibility with potential partners seems sufficient for the inclusion of both current and potential exchange partners.

Williamson (1975) refers to behavioral uncertainty as "self-interest seeking with guile" and includes in the concept the use of self-disbelieved statements and misinformation with the intention of profiting at the expense of the exchange partner. To summarize, potential partner uncertainty is "strategic" in nature and therefore of a behavioral nature.

This research seeks to assess the tradeoff between uncertainty/risk and expected returns. Given the composition of this decision node, the individual effects of the three types of uncertainty may be difficult to ascertain. Ideally, the nature of uncertainty (e.g., primary, competitive, and potential partner) and the extent of its influence on the acceptability of the risk/return tradeoff could provide many insights into the decision making process for altering a vertical coordination strategy.

2.4.5.2 Concluding remarks regarding acceptability of the risk/return tradeoff

The risk/return tradeoff is composed of two parts: (1) the role of expected profit in the vertical coordination decision, and (2) risk/uncertainty in the transaction. This research holds that the typical decision maker is a profit maximizer. Any change in vertical coordination strategy needs to generate the same or higher levels of absolute profit or at a minimum, generate similar amounts of expected profit. Both risk and uncertainty are used to capture behavioral and environmental factors affecting decision makers. Uncertainty in this research is divided into three distinct components: (1) primary uncertainty, (2) competitive uncertainty, and (3) potential partner uncertainty

Coordination strategies have often been used to reduce various types of risk/uncertainty (prices of inputs/outputs, quantity and quality, technology, etc.). For example, one reason that producers enter contracts is to increase income stability (reduce income variability and uncertainty) as compared to spot markets (USDA 1996: 3), and other forms of vertical coordination.

The effects of bounded rationality on the risk/return tradeoff have already been discussed, however, a few words regarding the influence of path dependence on the risk/return tradeoff is appropriate. Just as path dependence can lead to an entrenchment of institutions, it can also lead to an entrenchment of perceptions regarding the riskiness of a particular vertical coordination strategy. For example, the amount of trust the decision maker has in potential partners directly affects potential partner uncertainty. Trust by itself is path dependent in that developing trust requires a history of being "credible." Path dependence can be especially problematic when the decision maker needs to determine if the risk/return tradeoff can be improved.

The fourth decision node of the framework explicitly allows the risk/return preferences of the decision maker to be brought into the vertical coordination decision. If the risk/return tradeoff of the alternative strategy is acceptable, then the alternative has passed all four decision nodes and it will be adopted. If the risk/return tradeoff is not acceptable, the decision maker may find ways to improve the acceptability of the risk/return tradeoff. If the acceptability of the risk/return tradeoff cannot be improved, the alternative strategy will not be adopted.

2.4.6 Adoption of a new vertical coordination strategy

Once the decision maker has ascertained that a coordination error is costly, found an alternative which could reduce the costliness of a coordination error, identified effective management routines or has been able to conceive of them, found an alternative strategy to be implementable or found ways to overcome implementability constraints, and determined that the risk/return tradeoff associated with the alternative is acceptable or found methods to improve this tradeoff, an alternative strategy is ready for adoption (see Figure 2.12).

This framework allows for continual evaluation of vertical coordination strategies. An alternative vertical coordination strategy, once selected, may be re-evaluated against the criteria laid out in the framework. This reevaluating should begin by asking if coordination errors remain costly. If so, the process begins again and continues until the best strategy is found.

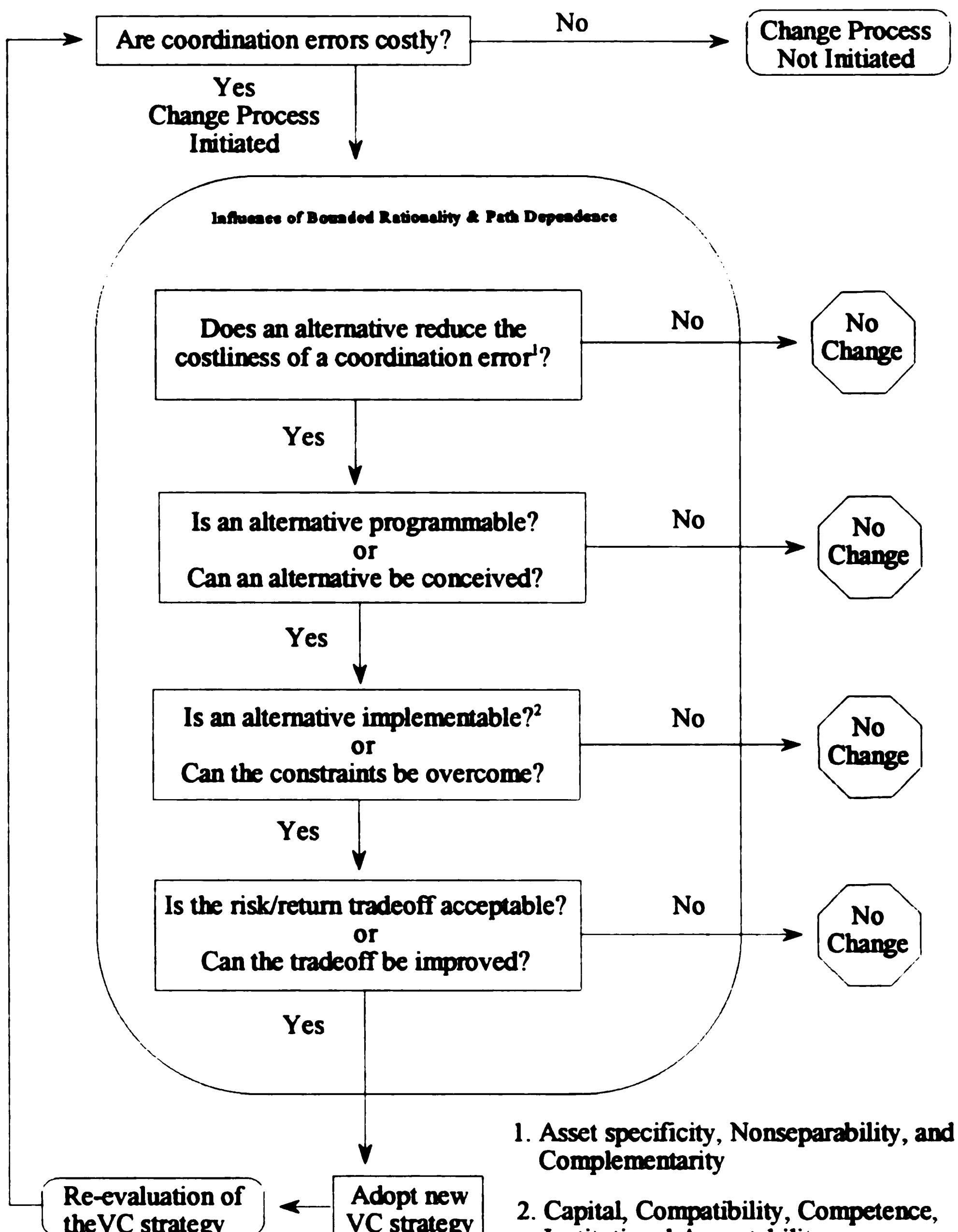

Figure 2.12 Adoption of A Vertical Coordination Strategy

2.4.7 *Concluding remarks regarding the decision process for altering a vertical coordination strategy*

The primary objective of this chapter was to present the framework used in this research. The framework models the decision process for altering a vertical coordination strategy. While a number of researchers have made valiant first-moves at designing frameworks to predict organizational form which includes, but are not limited to: Williamson, Alchain and Demsetz, Jensen and Meckling, Rumult and Teece, Mahoney, Eisenhardt, Boehlje and Schrader, and Polyani and Winters, and Martin et al. Reliance on any single theory eventually becomes too constraining and is not able to capture the complex and often "clumsy" way the decision process works. Choice of vertical coordination strategy is best modeled a flexible (versus static) process. The framework outlined in this chapter sought to extend and combine the theoretical advancements made by earlier scholars in economics, business, sociology, strategic management, and organization science. Specifically, this research is an extension of transaction cost analysis, positivistic agency theory, and the resource-based theory of the firm, which incorporates the knowledge-based view of the firm as a sub-component.

The decision process for altering a vertical coordination strategy is composed of a catalyst for beginning the decision process (i.e., are coordination errors costly?) and four distinct decision nodes that interact to create a flexible framework which include: (1) does an alternative reduce the costliness of a coordination error?, (2) is an alternative programmable or can effective management routines be conceived?, (3) is an alternative implementable or can the implementability constraints be overcome?, and (4) is the risk/return tradeoff acceptable or can the tradeoff be improved?

Costliness of a coordination error is based on the levels of asset specificity and nonseparability present in the transaction. Asset specificity is the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value. As the level asset specificity increases, the intensity of control needed increases. Vertical coordination strategies are well suited to carry out this intensity of control.

The level of nonseparability is determined by the level of standalone competitive advantage and the need for responsiveness in the transaction. Stand-alone competitive advantage, the need for linkages within a firm's value chain, and responsiveness to final consumers help to determine if the firm *needs* to pursue tighter vertical coordination strategies. If firms have limited stand-alone competitive advantage, see the need for linkages, and face a moderate to strong need to be responsive, then non-spot market types of vertical coordination are recommended.

Implementability of alternative vertical coordination strategies affected by constraints related to institutional acceptability, absolute levels and access to capital, the coordination competence of the decision maker, and the availability of compatible partners. Low compatibility suggests spot markets or vertical integration. Moderate compatibility is the most appropriate for specification contracts and formal cooperative arrangements, high compatibility is required for successful strategic alliances.

Whether or not a firm can manage tighter forms of vertical coordination, depends on coordination competence. Does the decision maker have the *ability* to choose different vertical coordination arrangements? Decision makers who exhibit coordination skills characterized as "horse-trader," "negotiator/ monitor," and "partner" respectively will be better suited for spot markets, specification contracts, and strategic alliances. Coordination skills that are characterized as "diplomatic," or "controller" are appropriate for formal cooperative arrangements and vertical integration.

The acceptability of the risk/return tradeoff is depends on the interaction between risk and anticipated returns. The decision maker explicitly takes this interaction into account when considering alternative vertical coordination strategies.

Although the above factors seem reasonable to consider in firm-level decisions about vertical coordination strategy, this alternative framework is far from having the clear mapping of factors into strategies that is found in Table 2.1 presentation of Mahoney's model. More theoretical and empirical work must be done to convert this into a meaningful set of prescriptive guidelines. This research is such an attempt to make this conversion.

2.4.7.1 An illustration of the proposed framework using a lettuce shipper example

Illustrating the decision process for altering a vertical coordination decision with an example concludes the framework's development. Assume a lettuce shipper moving toward adoption of a new vertical coordination strategy. Suppose the lettuce shipper decides to look for an alternative to selling lettuce on the spot market. He deems the fit at the transaction interface between his firm and the retail lettuce buyer as unacceptably costly because of potential hold-up costs due in part, to the perishability of lettuce (a form of asset specificity). The shipper knows that alternatives are programmable because a number of his neighbors belong to marketing cooperatives, while others are contracting lettuce to retail customers. He also knows that alternatives are implementable because institutional acceptability and capital should not be constraining in the present economic environment. While the shipper often finds himself at odds with retail buyers, he believes there is enough strategic compatibility between his firm and selected retail buyers to move from the spot market. Additionally, the lettuce shipper is willing to give up some of his horse-trading ways for say, more of a negotiation, partnering, or diplomatic style. After analyzing the risk/return tradeoffs between contracting and joining a marketing cooperative, the lettuce shipper decides to enter into a specification contract with three of the shipper's largest customers.

The above scenario is a highly simplified and condensed illustration of how a decision maker moves through the decision making process identified in the proposed framework. This research will utilize extensive case studies to capture the richness of detail needed to test this framework. The research methodology used to test the proposed framework is presented in the next chapter.

CHAPTER 3
RESEARCH PROPOSITIONS, RESEARCH STRATEGIES, AND SUPPORTING METHODOLOGY

When designing research, agribusiness scholars need to choose from two possible research epistemologies: (1) a research epistemology based on positivistic knowledge, or (2) a research epistemology based on phenomenological knowledge. Epistemology is defined and the differences between positivistic and phenomenological knowledge are discussed below. This is followed by an argument for a phenomenologically-based research methodology for this study. Investigators have a related decision to make concerning the appropriate choice of research strategy. Choice of research strategy involves selecting the best method for collecting data and gathering information.

On the surface, choice of the research epistemology and research strategy answer the same question: "What is the appropriate research methodology for this research?" Choice of research epistemology and research strategy will be shown to point to case research as the most appropriate research strategy given the specifics of this research problem. Despite the similarities between the choice of research epistemology and research strategy, the decision to select an appropriate research strategy (e.g., experiment, archive, case study) can, and often is, made separate from the choice of epistemology (positivistic or phenomenological knowledge). To capture the importance of each decision, the choice between positivistic and phenomenological knowledge is presented separately from the choice of research strategy.

In this study, the investigator chose a research epistemology (phenomenological knowledge) and research strategy (case study), followed by an appropriate research design. A research design is the logical sequence that connects the empirical data to the case study's initial research questions and, ultimately, to its conclusions.

All three decisions regarding choice of: (1) research epistemology, (2) research strategy, and (3) research design are discussed in this chapter. The research design section concludes with a discussion of the criteria for judging the quality of research designs based on construct validity, internal validity, external validity, and reliability.

A discussion of the proposed data collection procedures concludes this chapter. Data will be collected from published sources and from in-depth interviews with seed potato producers, celery producers, and professionals associated with these industries. The use of a multiple-strata quota sample and the questionnaire as a survey instrument completes the discussion of the data collection process.

3.1 Selecting the Appropriate Epistemology: Choosing Between Positivistic and Phenomenological Knowledge

Epistemology is the branch of philosophy that studies the nature of knowledge, its presuppositions and foundations, and its extent and validity. Simply put, it is the study of how people know what they know. The epistemology of this research is based on phenomenological knowledge rather than positivistic knowledge, and as such, is designed to build theory, rather than to disconfirm it. Positivistic knowledge is warranted when an existing body of knowledge or theory is well developed and researchers can use methods that seek to establish causality. Researchers seek methods high in data integrity such as laboratory experiments, models, and simulations. High data integrity builds confidence "that an observed relationship between variables is causal and that the absence of a relationship implies no cause" (Cook and Campbell 1979: p. 84). Once causation is established, replications (usually by other high data integrity methods) may be used to test the limits of (or corroborate) observed relationships. In other words, these methods are disconfirming in nature and are based on positivistic knowledge.

In contrast, phenomenological knowledge is warranted when the researcher's interests dictate theory building rather than verification or extension, the tasks of description, classification, and comparison become relevant. If properly conducted, these methods lead to a "deep understanding" (Geertz 1973), a fuller contextual sense of the phenomena under study (Miles 1979), and an explicit and purposeful movement toward theory building that often is missing from both simple descriptive work and most cause-and-effect research (van Maanen 1982). Researchers who first struggle to understand this theory building process may, under appropriate conditions, seek ways to move toward causal disconfirmation.

3.1.1 Positivistic knowledge and agribusiness research

The prevailing academic epistemology of agricultural economics is that of positivism[16]. Positivism is a scientific method of obtaining knowledge that is objective and

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[16]The foundation of this section is based on a paper written by Peterson, H. Christopher. "The Epistemology of Agribusiness: Methods of Agribusiness Scholarship," Michigan State University Department of Agricultural Economics, East Lansing Michigan, Staff Paper No. 97-25 (July 1997).

verifiable (Titus 1974). Positivistic knowledge is derived from theory. It is learned through deduction and is abstract in that the detail and noise of context are filtered and reduced in search of an underlying cause and effect. The assumption behind the positivistic paradigm is that an objective truth is existing in the world which can be revealed through the scientific method where the focus is on measuring relationships between variables systematically and statistically. The key concerns are that measurement is reliable, valid and generalizable in its clear predictions of cause and effect (Cassel and Symon 1994: p. 2), and that the social world exists externally, and that its properties should be measured through objective methods, rather than being inferred subjectively through sensation, reflection or intuition.

When positivistic knowledge is properly correspondent, generalizable, and strongly causal, it can have significant predictive power. In this sense, positivistic knowledge is often useful to decision makers, even if it solves no specific problem (Peterson 1997).

Positivistic knowledge is ultimately limited by its level of abstraction. The search for underlying structure, clarity, and coherence causes positivistic knowledge to ignore much of the detailed richness of a holistic situation. Bonoma (1985: p. 199) argues that positivistic knowledge has limited currency or ability to be generalized in that its contextual relevance is low and thus its applicability to any particular situation is limited. For example, the statistical validity of positivistic research has little relevance to a decision maker who must take action in a setting that resembles, but is not exactly the same as the conditions the positivistic knowledge was found to hold. Although positivistic knowledge is predictive about what may happen and can thus contribute to the analysis of a decision, it alone is not prescriptive in telling a decision maker how to make it happen (Peterson

1997). However, positivistic knowledge does have a role to play in this research and is discussed below.

3.1.1.1 The role of positivistic and normative knowledge in this research

The applicability of positivistic knowledge to a given decision making situation was stated as limited in the last section. Just as this research postulates the existence of a continuum of vertical coordination strategies, a range of knowledge classifications (including positivistic, knowledge of values, and prescription) exists for describing how people know what they know.

The above definition of positivistic knowledge assumes that positivistic knowledge is value free. Johnson (1986: p. 18) points out that not all positivistic knowledge is value free: "for instance, knowledge about who values what how much can be regarded as positivistic since it is not regarded as descriptive or real values." This research seeks to identify what factors (and their strength) decision makers regard as important in the decision making process for altering a vertical coordination strategy. In this sense, this research has an element of positivistic knowledge.

While the treatment of knowledge in this section is presented in a dichotomous form as either positivistic or phenomenological, there are other widely recognized forms of knowledge including normative and positivistic (Johnson 1986: 16-18). Johnson regards normative knowledge as including prescriptive knowledge and knowledge about values. Prescriptive knowledge is knowledge about what ought or ought not to have been done, or ought or ought not be done. Knowledge of values is knowledge concerning the goodness and badness of conditions, situations, and things (Johnson 1986: p. 16-18).

Under this dichotomous classification of knowledge (positivistic or normative), this research is primarily normative (consisting of prescriptive and knowledge of values). This research is prescriptive because it is hoped the framework can be used to prescribe appropriate vertical coordination strategies, given the characteristics of a decision making environment. This research is based on a knowledge of values by seeking to understand better what decision makers value (e.g., the goodness or badness of this value) when considering a change in vertical coordination strategy.

This research recognizes the importance of normative knowledge as defined above, especially as it relates to the overall framework as presented in Chapter 2. However, when discussing epistemology the main emphasis will be in distinguishing between positivistic and phenomenological knowledge.

3.1.2 Phenomenological knowledge and agribusiness research

At the heart of phenomenological knowledge is the notion that the phenomena of interest cannot be separated from the situation that created it (Peterson 1997). In the phenomenological approach, theory is generated from the data collected. Typically, the emphasis is on a constructivist (theory-building) approach where there is no clear-cut objectivity or reality. Phenomenological knowledge is grounded in inductive[17] versus deductive[18] thinking.

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[17]The process of deriving general principles from particular facts or instances and the conclusions reached by this process.

[18]The process of reasoning in which a conclusion follows necessarily from the stated premises; inference by reasoning from the general to the specific and the conclusions reached by this process.

Qualitative techniques emerge from the phenomenological paradigm and often do not use numbers. However, most qualitative researchers would agree the "countable should be counted" (Cassell and Symon 1994: p. 4). That is, quantitative analysis has a role to play in qualitative research, such as describing the nature of an industry (e.g., number of firms, average size, number of employees).

Qualitative research is less likely to impose restrictive a priori classifications on the collection of data. The research is less driven by very specific hypotheses and categorical frameworks and more concerned with the emergent themes and descriptions. Thus, one cornerstone of the qualitative approach is its acceptance of the inherent subjectivity of the research (Bryman 1988). The argument based on the search for objectivity is to some extent misguided for it is the participant's perspective on, and interpretation of, the situations which are of value in understanding behavior.

Qualitative methods under the phenomenological approach allow flexibility in the research process. The researcher must be aware of the individual's and organization's responses to inquiry and they must be willing to formulate new propositions and to alter old ones as the research progresses, in light of emerging insights. Bonoma (1985) calls this process the theory/data/theory-revision cycle of case research. Qualitative research demands that the researcher place him/herself in complex situations where one cannot exactly define what they are interested in or how to explore the issue at the outset (Cassell and Symon 1994: p. 4). For example, this research is designed to study the decision process for altering a vertical coordination strategy decision. Existing theories and experiences have enabled this investigator to identify factors of decision making a priori.

However, only after submersion into the decision maker's world, can the model's true worth and validity be established.

Only qualitative methods are sensitive enough to allow the detailed analysis of change. With quantitative methods, the researcher can probably assess that a change has occurred (i.e., a switch from one vertical coordination strategy to another) over time. However, one cannot say how or why (e.g., the alternative was programmable and the risk/return tradeoff was acceptable). One of the researcher's goals under phenomenological knowledge is to focus on meanings, trying to understand happenings. The investigator looks at the entire situation, developing ideas through induction from data. That is, the researcher is interested in developing "local" theory.

In summary, qualitative research under the phenomenological approach can be said to have many defining characteristics (Cassell and Symon 1994: p. 7): (1) a focus on interpretation rather than quantification, (2) an emphasis on subjectivity rather than objectivity, (3) flexibility while conducting research, (4) an orientation toward process rather than outcomes, (5) a concern with context regarding behavior and situation as inextricably linked in forming the experience, and (6) an explicit recognition of the impact of the research process on the research situation.

3.1.3 Positivistic or phenomenological knowledge: which is appropriate for this agribusiness research problem?

The phenomenological approach to research is growing in popularity in many fields, including organization science. Editors Daft and Lewin (1993) of the Organization Science journal urged scholars to develop new "organizational theories" that keep up with the changes taking place in the business world:

> "Probably the least promising approach to help define new organizational paradigms is traditional hypothesis-testing research. We ask scholars to resist the urge, to break with the tradition of 'deriving' and testing normal science research hypotheses that typically involve a slow multi-year sequence from conception to publication, with the resulting small knowledge yield. A midrange, grounded study of some part of a new organizational form would enable a scholar to learn first hand about it and provide new theory. We are proposing a role for organizational scholars that is primarily one of developing new variables and theories to describe new phenomena, not test hypotheses. If well done, the emerging knowledge will advance both organization theory and the practice of management." p. iii

Daft and Lewin echo many points made in this chapter over the differences between conducting research based on positivistic or phenomenological knowledge. The remainder of this subsection compares positivistic with phenomenological knowledge. An argument is presented for phenomenological knowledge, carried out primarily through the case study method in this research.

When positivistic approaches are used to investigate research topics about which theoretical development is scant or uncertain, research often is inefficient or misleading. Either the power of deductive methods is underutilized, or theory and/or methods are prematurely pressed into service when their underlying assumptions cannot be met (Bonoma 1985: p. 20). The premature application of "normal science" methods (theory testing) in situations where context-preserving theory-building methods might have been more appropriate has been a source of concern across the social sciences (Nisbett and Wilson 1977).

The tradeoff of increased precision (based on positivistic knowledge) for reduced generality (phenomenological knowledge) is not useful in all situations. Therefore, establishing criteria for choosing between positivistic and phenomenological knowledge to guide the research of a particular problem. The first characteristic that must be considered when deciding between a positivistic and phenomenological knowledge approach is to decide what the purpose of the research is. The theory regarding choice of vertical coordination strategy from a decision maker's perspective is evolving. This implies the key issues are accurate description, classification, and comparison which are well suited to phenomenological knowledge as opposed to issues of precision of measurement, or determination of strict causality common to positivistic knowledge (Bonoma 1985).

Bonoma (1985) discusses a second characteristic of research problems which distinguishes between the use of positivistic and phenomenological knowledge which is composed of two sub-components. The first sub-component asks can the phenomena of interest be studied separate from their natural setting? One earlier stated goal of this research is to get inside the "black box" of the firm and to better understand decision making processes used by agricultural producers. To study human phenomena, the researcher must understand the holistic nature of the situation that created it (Peterson 1997: p. 4). Behavior and context regarding choice of vertical coordination strategy are fundamentally interdependent. Reality is socially constructed by the actors involved in the phenomena. To understand the phenomena associated with this research problem, the researcher must understand the motivations of the actors involved in making vertical coordination decisions.

The second sub-component asks whether the phenomena are amenable to quantification? Agribusiness research and the determinants affecting the nature of firm-level coordination strategy decision making are not easily quantified. This research is concerned with theory-building and seeks to provide a first step in quantifying the motivation of decision makers regarding choice of vertical coordination strategy.

Peterson (1997) cites a third characteristic of the research that must be considered to decide when the use of phenomenological knowledge is appropriate. "To what extent is the underlying causal structure stable or changing?" Positivistic knowledge is possible if the underlying causal structure is stable. The underlying structure regarding choice of vertical coordination strategy is changing dramatically, due in part to the forces driving the industrialization of agriculture. Therefore, positivistic knowledge takes a background role in this research setting.

Peterson applies the three characteristics of inquiry to the current state of agribusiness research to illustrate how the issues of greatest relevance to agribusiness scholars fall outside the purview of positivism:

> "First, the fundamental shifting of agricultural business structures and market arrangements, i.e., the current industrialization of agriculture, suggests that underlying structure is changing dramatically. There is at present no stable underlying structure to study. Second, research into the area of business strategy for agribusiness firms is the study of how firms can create and choose strategic alternatives that have as their fundamental motivation altering the structure of the industry in which the firms operate. When the goal of the phenomenon being studied is to alter structure, how can the phenomenon be studied with methods that assume stability of structure? Business strategy is not amenable to positivistic study. Third, even when the phenomenon of interest appears stable, there may be no fundamental underlying structure to find. Long ago, management researchers gave up on the notion of a general theory of management, i.e., there is no true way to manage." p. 4

When the theory is strong, the phenomena are quantifiable and separable from context, and the structure is stable, the positivistic approach and methods are appropriate, if not required. However, the current phenomena of interest in this research are not amenable to the positivistic approach. Therefore, this research will rely on the phenomenological approach, and its theory/data/theory-revision cycle to develop a theory regarding the decision process for altering a vertical coordination strategy.

3.2 Selecting an Appropriate Research Strategy

This section on research strategies examines (1) alternative approaches for addressing the research problem, and (2) the case study as the preferred research strategy. Several alternative approaches to conducting social science research are examined. Their applicability to various types of research questions is then presented. The section on case study as the preferred research strategy contains a brief explanation of the major concepts, followed by the strengths and limitations of the case study research strategy, and concluding remarks regarding case study research.

3.2.1 Alternative approaches for addressing the research problem

Once the choice between positivistic and phenomenological knowledge has been made, there are several strategy types with which to approach social science research. These strategy types include experiments, surveys, histories, case studies, and the analysis of archival information. Each strategy has its advantages and disadvantages, depending upon three conditions: (1) the type of research question being asked, (2) the control the investigator has over actual behavioral events, and (3) the focus on contemporary as opposed to historical phenomena (Yin 1994).

The type of research strategy used in a particular study depends upon the phase of the research. Research phases can be either: (1) exploratory, (2) descriptive, or (3) explanatory in nature. Exploratory research is primarily concerned with answering "what" questions. Descriptive research is best suited to answer "who" and "where" questions, and explanatory research is based on answering questions of "how" and "why."

Table 3.1 presents the relevant situations for different research strategies. The five research strategies of experiment, survey, archival analysis, history, and case study are presented. Each strategy is discussed below according to the three conditions, and the importance of each condition.

Table 3.1 Relevant Situations for Different Research Strategies

Strategy	Form of Research Question	Requires Control Over Behavioral Events?	Focuses on Contemporary Events?
Experiment	How Why	Yes	Yes
Survey	Who What Where How Many How Much	No	Yes
Archival Analysis	Who What Where How Many How Much	No	Yes or No
History	How Why	No	No
Case Study	How Why	No	Yes

Source: COSMOS Corporation cited in Case Study Research: Design and Methods (Yin 1994)

3.2.1.1 *The type or form of research question being asked*

The first condition is the type or form of research question being asked. One categorization for these types of questions is the familiar "who," "what," "where," "how," and "why." Research questions that focus mainly on "what" questions are exploratory in nature. For example, Michigan seed potato producers could be asked "What, steps do you take when you are making a vertical coordination strategy decision?" Any of the five research strategies can be used in an exploratory study. However, table 3.1 suggests survey and archival analysis are best suited for exploratory study. In this research, exploratory research could be carried out by using face-to-face, phone interviews, and an extensive review of literature.

The second type of research question is based on "who, "where," "how many," and "how much," and are descriptive in nature; for example, "How much of your entire farm revenue is derived from seed production?". These questions favor survey strategies or archival analysis, common to agricultural economics research. These strategies are most advantageous when the research goal is to describe the incidence or prevalence of a phenomenon or when the goal is to be predictive about certain outcomes. In this study, descriptive research could be carried out with face-to-face, phone interviews, and study of archival records that could be requested from the Michigan Department of Agriculture and longtime industry participants. Descriptive analysis in this research will be used to describe the decision maker's environment for cases used in this study.

Explanatory research is best accomplished by asking "how" and "why" questions and are likely to lead to the use of case studies, histories, and experiments. Such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence (Yin 1994). Explanatory inquiry is crucial for better understanding the decision process in altering a vertical coordination strategy. For example, seed producers could be asked "Is the risk/return tradeoff from a given vertical coordination strategy acceptable?" In this study, explanatory research could be carried out by detailed, and sometimes lengthy, face-to-face and phone interviews.

3.2.1.2 Does the researcher have control over behavioral events?

Of the five research strategies, only one, the experiment, requires that the researcher has control over behavioral events. In this study, the researcher is likely to have little control over behavioral events. This means that conducting an "experiment" to achieve the explanatory power sought would not be advised. Of the three research strategies that are suitable for explanatory research, only histories and case studies do not require the investigator to have control over behavioral events.

3.2.1.3 Does the research focus on contemporary events?

Of the two remaining strategies suited for explanatory purposes, only the case study method focuses on contemporary events. Usually, case studies are the preferred strategy when "how," and "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context (Yin 1994).

3.2.2 Case study as the primary research strategy

It will now be argued that the case study research strategy is well suited to accomplishing the objectives of this research. The case study is a research strategy which focuses on understanding the dynamics present within single settings. Case study research involves a detailed examination of some few persons, items, or entities. The case study method is better conceived as a simultaneous treatment and observation that can be made over a period of time. The case study research strategy focuses on understanding the dynamics present within single settings (Eisenhardt 1989). Case analysis lends itself readily to include single or multiple cases. The case study approach, while used extensively in medical and psychological research, is gaining acceptance in the agricultural economics profession as a valid research tool.

There has been a transition in academic research from using clinical case studies of actual situations to develop generalizations through induction[19], to a research style based on deductive[20] methods using the falsification method of Popper[21] and the statistical methods of multi-variate analysis (Rumelt et al. 1991). Although case study research is well suited to inductive research methods, there is a place for case study analysis in deductive research. Case studies typically combine data collection techniques, such as archives, interviews, questionnaires[22], and observations. The evidence may be qualitative, quantitative or both (Eisenhardt 1989). Multi-variate analysis is designed for use in the interpretation of quantitative data, while the case study method can be used for both qualitative and quantitative data. In fact, this research will codify decision maker responses to carry out both quantitative and qualitative research. Put another way, the traditional role of case analysis in agricultural economics has been predominately, qualitative research. This research, although heavily qualitative, seeks to rely on both

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[19]The inductive method of reasoning states that science starts with experience and proceeds through observation and experiments to the framing of universal laws and theories.

[20]Deductive reasoning seeks to derive hypotheses from theory. Observations are gathered that supports, expands or contradicts theory and suggests further study.

[21]According to Popper, you can never demonstrate that anything is materially true, but you can demonstrate that some things are materially false. For a more detailed explanation of Popper's views see Blaug (1992). "The Methodology of Economics or How Economists Explain."

[22]A copy of the questionnaire used in face-to-face interviews is included in Appendix A.

qualitative and quantitative analysis obtained from in-depth field interviews which will be used to test the research propositions presented later in this chapter.

Case research, as defined in this study, refers to the qualitative and field-based construction of case studies. It is guided by a process model of discovery which leads to: (1) a set of the theoretical generalizations from the clinical observations, (2) clinical "constraint testing" of these generalizations, and eventually (3) a clinically validated theory of some strategic phenomenon. This was stated earlier as the theory/data/theory-revision cycle to be used in this research.

3.2.2.1 Strengths of the case study research strategy

Traditionally, case studies were thought only appropriate for the exploratory phase of an investigation, that surveys and histories were appropriate for the descriptive phase, and that experiments were the only way of doing explanatory or causal inquiries (Yin 1994). The traditional mind-set of the research phases reinforced the idea that case studies could not be used to describe or test propositions. A more appropriate view of these different strategies is that a case study strategy can be used for all three purposes: exploratory, descriptive, and explanatory.

The unique strength of a case study is its ability to deal with a full variety of evidence: documents, artifacts, interviews, and observations. The case study lends itself to the task of investigation of a complex process that contains many uncontrollable variables of unknown importance a priori. It is the method of choice under such conditions where it is desirable to obtain a wealth of detail and primary data about the subject of interest

(Simon 1978). In this respect, the case study method is ideally suited for exploring the complex decision process for altering a vertical coordination strategy.

Subjective factors such as trust, risk and many other components of the proposed framework cannot be measured post hoc using accounting data. In a subjective interpretation, the costs that are relevant to the decision are those considered in the decision calculus of the decision maker at the moment of decision. To measure these subjective transaction costs, investigators must therefore gather data via direct contact with decision makers (Parkhe 1993). The case study itself is best regarded as a self-contained analysis of an often complex situation, relationship, or system that seeks to test an explanation of what is observed rather than a single variable or factor (Woods 1995).

Study of individual cases allow the researcher to learn intricate details and provides insight into the problem being considered, which aids in the process of prescribing a course of action (Kennedy 1979). This detailed insight is required when it is necessary to probe deeply into systems governing behavior and the interrelationships between people and institutions: to establish and explain attitudes and beliefs, and to show why certain behavior occurs (Casley and Lury 1987).

The case study uses a mixture of methods including: personal observation, the use of informants for current and historical data, straightforward interviewing, and the study of relevant documents and records. The concentrated, skill-intensive nature of the case study enables the use of both objective methods of measurement and the detailed probing of attitudes and background. The case study is best employed when the analyst is presented with an unusual opportunity to examine and interact with an actual, ongoing process in its real-life context (Yin 1981).

The differences between case research and more high-data-integrity methods are important to note. First, the goal of data collection in case research is not quantification or even enumeration, but: (1) description, (2) classification (typology development), (3) theory development, and (4) limited theory testing. In a word, the goal is understanding. Second, most enumeration is of little value to a case researcher. The goal is not the breadth or representativeness of large sample size research, but the depth of the knowing. The risks of low data integrity are traded for the currency and contextual richness of what is learned (Bonoma 1985: p. 206).

The case study method can be invaluable in the formative stages of investigation when hypotheses or propositions are not fully formed, and when engaging in the pursuit of clues or guidelines for further research. The challenge facing the researcher then is to investigate objectively and to describe what could be seen or confirmed by another observer (Simon 1978).

3.2.2.2 Weaknesses of the case study research strategy

Case studies have often been viewed as a less desirable form of inquiry than either surveys or experiments. The greatest concern has been over the lack of rigor of case study research. Unfortunately, all too often, case study investigators have been sloppy and have allowed equivocal evidence or biased views to influence the direction of the findings and conclusions. Yin cautions that what is often forgotten is that bias can also enter the conduct of experiments and the designing of quantitative instruments such as questionnaires. Problems of bias are common to all five of the research strategies mentioned earlier, but in case study research, they may have been more frequently encountered and less frequently overcome (Yin 1994).

The second concern about case studies is that they provide little basis for scientific generalization. How can one generalize from a single case? The answer to this question is not an easy one. One could ask the same kind of question of an experiment: "How can you generalize from a single experiment?" Yin addresses this topic specifically in his book "*Case Study Research: Design and Methods*" published in 1994:

> "Case studies, like experiments, are generalizable to research propositions and not to populations or universes. In this sense, the case study, like the experiment, does not represent a "sample," and the investigator's goal is to expand and generalize theories (analytic generalization) and not to enumerate frequencies (statistical generalization)." p. 10

A common criticism of generalizing from a small sample to a larger population is that the researcher must be careful to avoid oversimplification. Inferences based on generalizations are always tentative. Data might offer confirming or disconfirming evidence, but never conclusive evidence. Data observed from the case can include complex system interrelationships that may or may not be unique to the conditions under which they were observed. Inferences drawn from these data may be improved by combining observations from the case study with economic, business, or organizational theory and other cases, even if unrelated (Kennedy, 1979).

An additional question regarding generalizing from case study is, "Can researchers generalize from the statements of purposely selected respondents?" How can one generalize from the statements of witnesses not randomly selected to validate statements about the whole group under study? The key lies in the homogeneity of the group being studied. If a group is sufficiently homogeneous, then it is possible that limited inquiries may work satisfactorily (Casley and Lury 1987). Interview responses of the Michigan seed potato and celery industry producers will be studied to learn if seed potato producers and celery producers share common experiences and physical market locations in their respective industries, and therefore can be considered a homogeneous group. Both groups of producers are believed to be sufficiently homogenous to make it possible to carry out a separate case study for each industry.

The detail and time demanded to conduct a case study limit the number of case studies that can be conducted. This implies a need to select subjects in a way that is not random, but selected in a way that assures representation of the various types of interest within the two industries studied. If selected at random, some interests would be over represented, while others under represented. Stratification may resolve this problem allowing for random selection in each stratum. Although a single case study may be too small to make generalizations on an entire population (i.e., the entire U.S. seed potato and celery industries), one can probably make generalizations on specific sub-populations, such as the Michigan seed potato and celery industries. A large sample or number of cases are not needed to develop theory. Theory can be developed, and conclusions drawn, without direct observation. The difficulty is not in generating theory, but in generating good theory (Casley and Lury 1987).

The primary researcher plays a key role in the case study approach. That is, the primary researcher must work hard to obtain useful data and be careful to remain objective. The investigator for this study will use the opinions of key non industry participants (e.g., his research committee and university faculty outside agricultural economics) as a check against research bias.

The case study approach is often criticized for being limited by researcher's preconceptions. The researcher must be on guard against building a theory or arriving at conclusions which are too narrow or idiosyncratic. However, a researcher using a case study approach should not be alarmed when realities conflicting with reality arise because these conflicting realities may in fact lead to the generation of theory and conclusions with less researcher bias (Eisenhardt 1989).

3.2.2.3 Concluding remarks regarding the case study research strategy

In summary, a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident. Case study inquiry: (1) copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result, (2) relies on multiple sources of evidence, and as another result, (3) benefits from the prior development of research propositions to guide data collection and analysis.

The critical difference between case research and other legitimate, but nonscientific use of cases is that the research objective of the investigator should guide a coherent application of case method across numerous cases for theory development and testing (Bonoma 1985: p. 204). This research seeks to develop a more thorough theory of the decision making process for altering a vertical coordination strategy, and will be based on the application of multiple cases for theory development and testing.

Often the case study is contrasted with other research strategies to argue the superiority of one research strategy over another. This disguises the fact that any research strategy has limitations and problems. The main issue is what strategy is most appropriate to the research being conducted (Casley and Lury 1987). Given the form of research questions to be asked, the researcher's lack of control over behavioral events, and the focus on contemporary events, the case study research strategy is a superior tool for carrying out an investigation regarding the decision process for altering a vertical coordination strategy in the Michigan seed potato and celery industries.

The case method of research makes sense for analyzing the choice of vertical coordination strategy in the Michigan seed potato and celery industries for three reasons: (1) the relatively small number of producers in their respective Michigan industries makes it easier to draw industry-wide conclusions based on a limited number of detailed observations (comprising the Michigan seed potato case and the Michigan celery case), (2) the complexity of the decision process for altering a vertical coordination strategy requires in-depth study and analysis to understand the dynamics present in the respective Michigan industries, and (3) due to the theory building and prescriptive nature of the research, the case study findings should allow agricultural decision makers in other industries to adapt specific parts of this analysis to their individual circumstances.

3.3 Research Design

Once the investigator has selected a research epistemology (phenomenological knowledge here) and research strategy (case study for the current research), a research design must be chosen. A research design is an action plan for getting from the initial set of questions to be answered, to some set of conclusions (answers) about these questions. Between these two points may be found many major steps, including the collection and analysis of relevant data (Yin 1994: p. 19). Research design is the overall strategic choice made with the purpose of coming up with an approach that allows for answering the research problem in the best possible way-within the given constraints (Ghauri, et al. 1995). The constraints placed on the researcher, include time, budgetary and investigator skill level.

A research design is a plan that guides the investigator in the process of collecting, analyzing, and interpreting observations. It is a logical model of proof that allows the researcher to draw inferences concerning causal relations among variables under investigation. The research design also defines the domain of generalizability, that is, whether the obtained interpretations can be generalized to a larger population or to different situations (Nachmias and Nachmias 1992).

The main purpose of the research design is to help avoid the situation in which the evidence does not address the initial research problem. In this sense, a research design deals with a logical problem and not a logistical problem. This research seeks to better understand the decision process for altering a vertical coordination strategy. The research questions relate to factors both inside and outside the decision maker's firm. For example, does the decision maker have adequate access to capital and/or are available partners compatible? If the study is completed by examining only factors internal to the decision maker's firm, accurate conclusions cannot be drawn on the external factors, and therefore the study would be flawed (Yin 1994). This is a problem with research design, not with the way the research was conducted. This study will focus on factors, both internal and external to the decision maker to model the decision process for altering a vertical coordination strategy.

The remainder of this subsection is devoted to explaining the case study research design that will be used to explore the decision process for altering a vertical coordination strategy. The components of the case study research design are discussed below and include: a study's questions, its propositions, the unit(s) of analysis, the logic linking data to the propositions, and the criteria for interpreting the findings. A discussion of the criteria for judging the quality of research design concludes this subsection.

3.3.1 A study's questions

This first component has already been discussed in detail under the section titled "Alternative approaches for addressing the research problem." It was suggested that the form of the research question, about "who," "what," "where," "how," and "why" provides an important clue regarding the most relevant research strategy to be used. The case study strategy is most likely to be appropriate for "how," and "why" questions. An argument was presented for the need to ask "how" and "why" questions, to accomplish a primary objectives of this research

One primary objective of this research is to explain the decision making process, which implies that one must identify how decision makers go about deciding the choice of vertical coordination strategy. Knowing what the important factors are to be considered is also useful, and why they are important in the choice of vertical coordination strategy. These "how" and "why" questions will be asked throughout the application of the proposed framework.

3.3.2 Research propositions

This research does not lend itself easily to the creation of multiple hypotheses or propositions that can be tested with sophisticated statistical techniques. The detailed nature of the analysis, limited number of observations, lack of specific numerical data, and the need for theory development limit standard hypothesis testing. Research propositions, based on the proposed framework (see Figure 3.1) are used in this study instead of hypotheses because propositions direct the researcher's attention to something that should be examined within the scope of the study (Yin 1994), while hypotheses are preliminary assertions regarding some unknown phenomena (Ghauri 1995). While interchanging these two definitions is possible, associating propositions with case studies and hypotheses with other research strategies is traditional. This research lends itself to the testing of research propositions by applying the proposed theoretical framework (i.e., the decision process for altering a vertical coordination strategy) to individual case studies, and then comparing the findings across multiple case studies. For example, there are three industry-based case studies: (1) the Michigan seed potato industry, (2) the Wisconsin seed potato industry, and (3) the Michigan celery industry. Besides the three industry case studies, there are twenty case studies based on individual producers in the Michigan seed potato and Michigan celery industries.

Given the need to study the "contextual conditions" of the cases and the nature of the propositions, there are likely to be more variables of interest than there are data points. Yin addressed this issue of "messy" research stating:

> "Unlike statistical analysis, there are few fixed formulas or cookbook recipes to guide case study analysis for novices. Instead, much depends on an investigator's own style of rigorous thinking, along with the sufficient presentation of evidence and careful consideration of alternative interpretations." p. 102-103

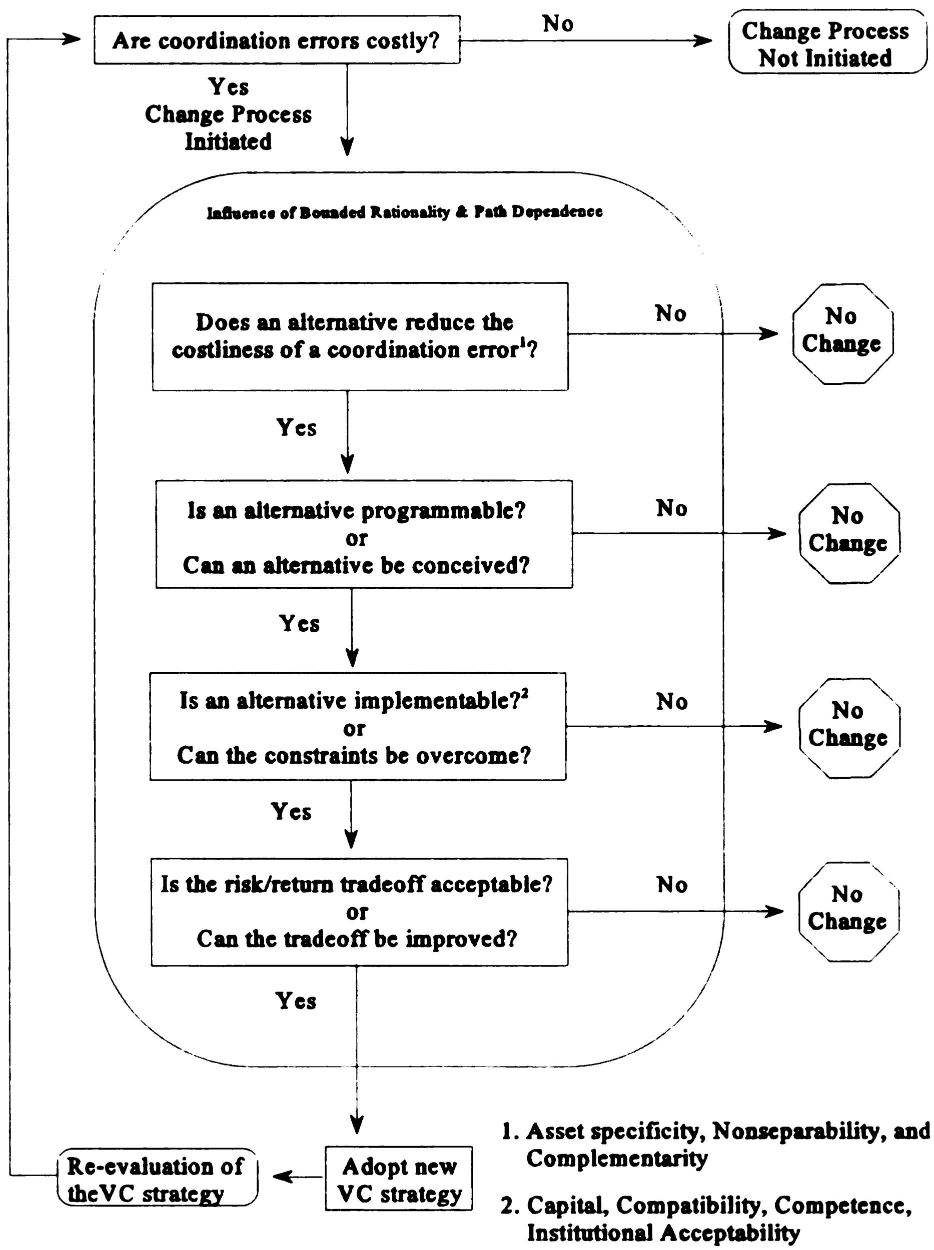

Figure 3.1 The Decision Process for Altering a Vertical Coordination Strategy

The theoretical propositions are constructed to unravel some complexity surrounding the vertical coordination decision process, while allowing for alternative interpretations. The propositions are formulated to mimic the decision process used by managers when considering alternative vertical coordination strategies. In the beginning of the research process, four research propositions or areas of study were identified.

3.3.2.1 The four research propositions

The four research propositions are taken directly from the proposed framework as represented in Figure 3.1. Decision makers are constantly reevaluating their strategies, cycling through the framework. Given the structural changes taking place in the industries studied and the focus of this research on the decision process itself, the initiating catalyst is regarded as having taken place (i.e., coordination errors are costly). Each of the four research propositions states a cause and effect relationship between a change in vertical coordination strategy and the four decision nodes of the proposed framework.

The four research propositions are:

RP_1: If: (1) an alternative strategy reduces the costliness of a coordination error, and (2) the alternative strategy is programmable, and (3) the alternative strategy is implementable, and (4) the risk/return tradeoff of the alternative strategy is acceptable, then a change in vertical coordination strategy will occur.

RP_2: If: (1) an alternative strategy does not reduce the costliness of a coordination error, or (2) the alternative strategy is not programmable, or (3) the alternative strategy is not implementable, or (4) the risk/return tradeoff of the alternative strategy is unacceptable, then a change in vertical coordination strategy will not occur.

RP_3: If a change in vertical coordination strategy has occurred, then: (1) an alternative strategy has reduced the costliness of a coordination error, and (2) the alternative strategy was programmable, and (3) the alternative strategy was implementable, and (4) the risk/return tradeoff of the alternative strategy was acceptable.

RP_4: If no change in vertical coordination strategy has occurred then: (1) an alternative strategy did not reduce the costliness of a coordination error, or (2) the alternative strategy was not programmable, or (3) the alternative strategy was not implementable, or (4) the risk/return tradeoff of the alternative strategy was unacceptable.

Research propositions one and three and research propositions two and four while worded similarly, are converse statements of each other which state differing directions of causality between the independent variables and the dependent variable.

If the proposed framework is in fact, an accurate model the decision making process for altering a vertical coordination strategy, then the four research propositions form the necessary and sufficient conditions for changing or not changing a vertical coordination strategy. Research proposition one describes the necessary condition for a change in strategy to take place. While research proposition two describes the necessary condition for no change in strategy to take place. Research proposition three characterizes the sufficient condition for a change in strategy which has taken place, and research proposition four characterizes the sufficient condition for when a change in strategy has not taken place.

The research propositions will be tested to verify that the decision process for altering a vertical coordination strategy is composed of an alternative that lessens the costliness of a coordination error, the programmability of alternative coordination strategies, the implementability of alternative strategies, and the acceptability of the risk/return tradeoff for alternative coordination strategies. The Michigan seed potato and Michigan celery industry case studies, and the resulting interview responses will be structured in a way which allows testing of the relevance of each of the four decision nodes.

Lessening of the costliness of a coordination error

If a coordination error is costly, there may be alternative strategies available that lessen the costliness of a coordination error. When an alternative strategy does not match the asset specificity and/or nonseparability/ complimentarity of the transaction there is no reason to switch vertical coordination strategies. The decision maker may not like the current vertical coordination strategy, but the available alternatives may be more costly as to asset specificity and/or nonseparability/complimentarity.

Programmability

When alternative strategies can be identified at the transaction interface, the coordination strategy is said to be programmable. In other words, do management routines exist in practice, and are they accessible to the decision maker? If known effective management routines for alternative coordination strategies exist, the decision maker has a model to follow regarding alternative coordination strategies which would make adoption of these alternatives easier.

The decision maker may look toward theory or any other possible source for effective management routines that can be used to carry out an alternative vertical coordination strategy. The decision maker's creativity may allow him/her to create effective management routines which can be applied to alternative vertical coordination strategies.

If a known alternative coordination strategy is not programmable, but alternative are conceivable, alternative strategies become available which no longer prevent the alternative from being considered because of a lack of programmability. For those instances when effective alternative management routines cannot be found in practice, in theory, or anywhere else, the decision maker is locked into the current vertical coordination strategy, because there is no known effective management routine available which would allow successful adoption of an alternative strategy.

Implementability

The implementability of an alternative coordination strategy is based on a combination of four factors: (1) the institutional acceptability of alternative strategies, (2) the absolute amount, and access to capital required by alternative strategies, (3) the compatibility of the decision maker's firm with available partners required by alternative strategies, and (4) the coordination competence of the decision maker. Any one of the four factors may be constraining enough to prohibit the adoption of an alternative vertical coordination strategy.

If none of these four factors are found overly constraining, alternative vertical coordination strategies are said to be implementable. When one or more of the factors are constraining to the point of preventing the adoption of an alternative vertical coordination strategy, the decision maker must look for ways to overcome this problem. If an alternative coordination strategy is not implementable, but the constraints can be overcome, the alternative vertical coordination strategy becomes implementable.

If the decision maker is not able to overcome constraints caused by institutional acceptability, capital needs, compatibility or competence issues, the decision maker is better off sticking with their current vertical coordination strategy as opposed to choosing an alternative. With institutional acceptability, a particular vertical coordination strategy may not even be allowed (e.g., in mergers and antitrust laws).

Acceptability of the risk/return tradeoff

As the name implies, the risk/return tradeoff captures the tradeoff between the risk a decision maker is willing to accept in exchange for an expected amount of profit (return). For a complete discussion of risk and return, the reader is referred to Chapter 2. The nature of this measure is highly subjective, in the sense that different decision makers can arrive at the same tradeoff with very different combinations of preferences for risk and expected profit.

Acceptability of the risk/return tradeoff suggests that the decision maker has compared the risk/return tradeoff of his/her current coordination strategy to alternative risk/return tradeoffs and deemed the risk/return tradeoffs from alternative strategies to be acceptable. If the decision maker reaches this point in the decision process, the framework suggests that the next step is the adoption of an alternative vertical coordination strategy.

If the risk/return tradeoff of an alternative coordination strategy is not acceptable, but the tradeoff can be improved, there may be alternative vertical coordination strategies available which could lead to an acceptable risk/return tradeoff. This implies the risk averse decision maker has found a way to improve the risk/return tradeoff of an alternative by lowering the risk, increasing the expected profit, or a combination of lowering the risk and increasing the expected profit.

In summary, decision makers change their vertical coordination strategy only after a dynamic and complex decision process where: (1) the transaction interface is unacceptably costly, (2) alternative strategies are programmable or programmable alternatives can be conceived, (3) alternative strategies are implementable or the constraints can be overcome, and (4) and the risk/return tradeoff is acceptable or the tradeoff can be improved.

3.3.2.2 Concluding remarks regarding the theoretical propositions

Empirical testing of the research propositions will be accomplished by using methodological triangulation[23] (Patton 1980: p. 60); that is, the use of multiple methods to study a single problem (Ghauri, et al. 1995). This research will rely on the following multiple data collection procedures: (1) conducting of multiple detailed case studies based on in-depth interviews that will apply currently observed events of two Michigan industries against the proposed framework, and (2) the historical evolution of these two industries as documented by scholarly articles, trade publications, and eyewitness testimony.

There are strengths and weaknesses to any single data collection strategy. Using more than one data collection approach permits the researcher to combine the strengths and to correct some deficiencies of any one source of data. Building checks and balance into a design through multiple data collection strategies is called triangulation (Jankowicz

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[23]Methodological triangulation is similar to what Bonoma (1985) describes "perceptual triangulation," as a method for providing a fuller picture of the business unit under study. Prime sources for perceptual triangulation include: financial data, market performance data, market and competitive data, written archives, business plans, and direct observations of management.

1995; Ghauri et al. 1995). Researchers can improve data validity and generalizability by using triangulation. As Patton put it:

> "The triangle is the strongest of all geometric shapes, and triangulated data collection designs are aimed at increasing the strength and rigor of data collection." p. 60

These research propositions will be compared with the actual qualitative and quantitative findings of the case studies. The results of this comparison will be presented in Chapter 5: Conclusions and Implications for Further Research.

3.3.3 The unit(s) of analysis used in this research

The third component of a research design deals with defining the case. In other words, what is the unit of analysis to be used? The investigator has many choices regarding the unit of analysis in case study research including: the individual, industry, or event. For example, some case studies focus on decisions about programs, about an implementation process, or about organizational change.

The unit of analysis for this research is the *decision process for altering a vertical coordination strategy*. It is the process of decision making regarding how and why managers choose a particular vertical coordination strategy that this research is interested in. Yin (1994) cautions that:

> "Choosing an event or an entity that is less well defined, such as a process, is not easily demarcated in terms of beginning or end points of the 'case.'...As a general rule, the definition of the unit of analysis (and therefore the case) is related to the way the initial research questions have been defined." p. 22

The initial questions in this research have been defined in understanding the vertical coordination decision making process of agricultural decision makers who operate in an increasingly "industrialized" agricultural environment.

To keep this study within feasible limits, the unit of analysis (the decision process for altering a vertical coordination strategy) will be studied at two specific transaction interfaces[24] including: (1) the production-marketing interface, and (2) the marketing-buyer interface. Studying the vertical coordination decision process at specific transaction interfaces not only allows the scope of the study to be manageable, it also gives the investigator additional cases to explore the validity of the proposed framework.

3.3.3.1 Types of designs for case study strategy

For the case study strategy a decision must be made regarding choice of a single-case design or a multiple-case design. The rationale for each design is now discussed. A primary distinction in designing case studies is between single and multiple case designs. This means a decision, before any data collection, on whether a single case or multiple cases are going to be used to address the research problem needs to be made (Yin 1994). One rationale for using a single case is when it represents the critical case in testing a well-formulated theory. Since this research seeks to build theory, rather than disconfirm existing theory, a single case design would not be appropriate. A second rationale for using a single case design is when the case represents an extreme or unique case. However, this research seeks to identify generalizable patterns to understand the vertical coordination decision process. It is hoped that any heightened understanding could be used to aid decision makers regarding vertical coordination strategies across multiple agricultural commodities. Therefore, this research is concerned with identifying common

[24]In the previous chapter a transaction interface was described as one of the linkages comprising a product/service value chain, for example the genetics-production interface.

versus extreme vertical coordination decision characteristics which does not favor a single case design.

When a study contains more than a single case, it is called a multiple case design. Multiple case designs have increased in frequency over the past few years (Yin 1994). One advantage of a multiple case design is that the evidence from multiple cases is often considered more compelling and the study is therefore regarded as more robust (Herriott and Firestone 1983). However, the decision to undertake multiple case studies should not be taken lightly. Every case should serve a specific purpose within the overall scope of inquiry. The investigator should consider multiple cases as one would consider multiple experiments, that is, to follow a "replication" logic (Yin 1994). This research predicts the proposed framework will explain the vertical coordination decision process in cases across the Michigan seed potato and celery industries. If similar results are predicted for each case, replication is said to have taken place.

The logic underlying the use of multiple cases is the same. Each case must be carefully selected so that it either predicts similar results (a literal replication) or produces contrasting results but for predictable reasons (a theoretical replication). This replication logic, whether applied to experiments or to case studies, must be distinguished from the sampling logic commonly used in surveys. According to the sampling logic, most respondents are assumed to represent a larger pool of respondents, so that data from a smaller number of persons are assumed to represent the data that might have been collected from the entire pool (Yin 1994).

The replication approach to multiple case studies is illustrated in Figure 3.2.

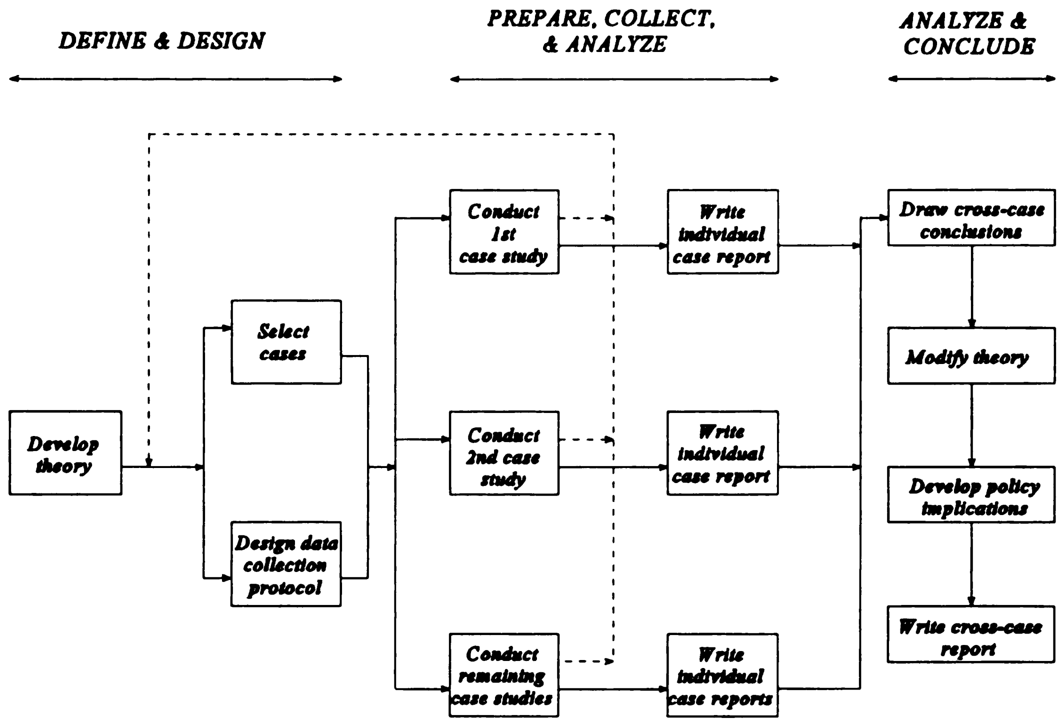

Figure 3.2 Case Study Method
Source: COSMOS Corporation cited in Case Study Research: Design and Methods (Yin 1994)

The figure suggests the first step in designing the study must consist of theory development and then shows that case selection and the definition of specific measures are important steps in the design and data collection process. Each individual case study consists of a "whole" study, in which convergent evidence is sought regarding the facts and conclusions for the case. Each case's conclusions are then considered information needing replication by other individual cases (Yin 1994). Figure 3.2 also illustrates the theory/data/theory-revision cycle described earlier in this chapter.

3.3.3.2 *The logic linking the data to propositions and the criteria for interpreting the findings*

Yin states that the linking of data to propositions and the criteria for interpreting the findings are the least developed components of case design. He does offer that the one promising approach for case studies in this regard is the idea of "pattern-matching" as described by Campbell (1975). The use of pattern matching requires the investigator to take several pieces of information from a given case and see if these apply to the theoretical propositions. Yin illustrates the idea of pattern matching by relating an example told by Campbell:

> "In his article, Campbell first showed how the annual number of traffic fatalities in Connecticut had seemed to decline after the passage of a new state law limiting the speed to 55 miles per hour. However, further examination of the fatality rate, over a number of years before and after the legal change, showed unsystematic fluctuation rather than any marked reduction. A simple eyeball test was all that was needed to show that the actual pattern looked unsystematic rather than following a downward trend, and thus Campbell concluded that the speed limit had no effect on the number of traffic fatalities." p. 25

What Campbell did was describe two potential patterns and then show that the data matched one better than the other. If the two potential patterns are considered rival propositions (an "effects" proposition and a "no effects" proposition in the traffic study example), the pattern matching technique is a way of relating the data to the propositions. This research will rely heavily on pattern matching to link data to the stated research propositions.

Yin suggests that there can be a great deal of difficulty in establishing the criteria for interpreting the findings from a case study. For example, in the Campbell traffic study, the data matched one pattern much better than another pattern. This begs the question of how close does a match have to be to be considered a match? Yin offers little insight into this issue other than to say "One hopes that the different patterns are sufficiently contrasting so that the findings can be interpreted in terms of comparing at least two rival propositions."

The criteria for interpreting the findings in this research is relatively straightforward. Data collected via the multi-case design will be arranged into patterns and these patterns will be matched against the theoretical propositions of the proposed framework. In other words, do the findings of the industry and individual firm level cases for the Michigan seed potato and Michigan celery industries support or contradict the proposed framework of the decision process for altering a vertical coordination strategy?

3.3.4 Criteria for judging the quality of the research design

A research design is supposed to represent a logical set of statements, such as the study's questions, propositions, unit(s) of analysis, the logic linking data to propositions, and the criteria for interpreting the findings. A complete research design covers these five components, but also requires the development of a theoretical framework for the case study that is to be conducted (Yin 1994). Chapter 2 of this dissertation was devoted to such a theoretical framework. The use of theory, in doing case studies, not only is an immense aid in defining the appropriate research design and data collection but also becomes the main vehicle for generalizing the results of the case study.

The theory/data/theory-revision cycle is integral to case study design and research. Generalizations made on this model are characterized as "analytical generalization" as compared to "statistical generalization." The differences between analytic and statistical generalization are presented below. This is followed by a discussion of the criteria which will be used to judge the quality of the analytic generalization of the case study approach used in this research.

3.3.4.1 Analytic generalization versus statistical generalization

Theory development simplifies the data collection phase of phenomenologically-based approaches such as case studies, and appropriately developed theory is the level at which the generalization of the case study results will occur. The role of theory in this sense is considered analytic generalization and this is in contrast to statistical generalization. In statistical generalization, an inference is made about a population (or universe) based on empirical data collected about a sample. This is called level one inference (see Figure 3.3). This method is commonly recognized because research investigators have ready access to formulas for determining the confidence with which generalizations can be made, depending mostly on the size and internal variation within the sample. It is a fatal flaw to try to generalize case study results based on statistical generalization. This is because cases are not sampling units and should not be chosen for this reason (Yin 1994 p: 31). Rather, individual case studies are to be selected as a laboratory investigator selects the topic of a new experiment.

Analytic generalization relies on previously developed theory to be used as a template with which to compare the empirical results of the case study. If two or more cases are shown to support the same theory, replication may be claimed. This type of generalization is shown as a level two inference in Figure 3.3. Analytic generalization will be carried out during the theory/data/theory-revision cycle of this study.

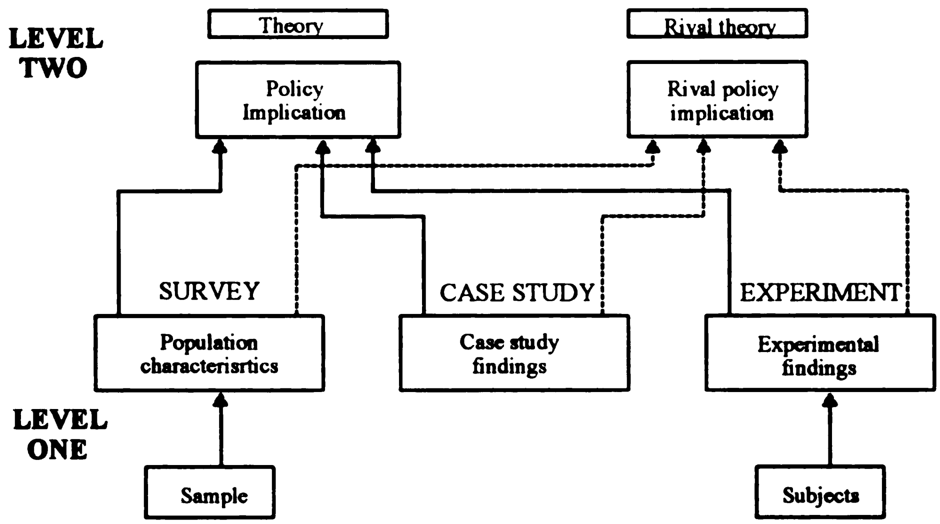

Figure 3.3 Making Inferences: Two Levels

Source: COSMOS Corporation cited in Case Study Research: Design and Methods (Yin 1994)

Quantitative analysis will be accomplished by coding the responses from the in-depth interviews into categorical variables. These variables will then be analyzed with the use of F tests, chi-quare statistics, discriminant analysis, and logistic regression.

3.3.4.2 Construct validity, internal validity, external validity, and reliability

Four tests have been commonly used to establish the quality of any empirical social research. Since case studies are one form of empirical research, the four tests of construct validity, internal validity, external validity, and reliability are also relevant to this research (Yin 1994: p. 31). Each of these tests and their applicability to this research is now presented.

3.3.4.2.1 Construct validity

Construct validity, in general terms, means "the ability of a construct's indicators to measure accurately the concept under study." (Hair, et al. 1987). In other words, does the study capture what it is supposed to capture? Validity is determined largely by the investigator, because the original definition of the construct or concept is proposed by the researcher and must be matched to the selected indicators or measures.

Yin describes construct validity as "establishing correct operational measures for the concepts being studied" (1994: p. 33). "Validity in the research context means that a theory, a model, concept, or category describes reality with a good fit, just like a good map properly describes earth" (Gummesson 1991: p. 81). In this research, construct validity is more than just establishing the correct operational measures. Construct validity, as defined in this research, are how well the concepts of the proposed framework can be operationalized. That is, do the constructs/concepts of the proposed framework parallel reality? For example, do agricultural decision makers really concern themselves with how costly is the fit of a given transaction interface? The proposed framework was designed to represent the "reality" of the vertical coordination decision making process. On the surface, the proposed framework regarding the decision process for altering a vertical coordination strategy appears to exhibit construct validity. The construct validity of the proposed framework will be assessed throughout the multi-case approach used in this research, but construct validity will be addressed specifically during the data collection and case write-up phases.

3.3.4.2.2 <u>Internal validity</u>

Internal validity is most appropriate for explanatory or causal studies, and not for descriptive or exploratory studies (Yin 1994: p. 33). According to Yin, internal validity is present when the investigator can establish a casual relationship, under which certain conditions are shown to lead to other conditions, as distinguished from spurious relationships. From a statistical point of view there are many threats to validity, mostly arising from spurious effects, such as effects from events external to the study that occur at the same time.

This research claims internal validity exists when the individual components of the proposed framework are shown to make sense. In other words, are the results obtained within the study true (Ghauri, et al. 1995: p. 33)? For example, the proposed framework regarding the decision process for altering a vertical coordination strategy be tested to see if it explains vertical coordination decisions when applied to specific cases in the Michigan seed potato and Michigan celery industries.

The testing of internal validity occurs during the data analysis phase of the research and is tested by using qualitative (i.e., pattern matching and explanation building form the case studies) and quantitative (discriminant analysis and logistic regression) findings to test the casual relationships stated in the four research propositions. The methodological aspects of discriminant analysis and logistic regression are presented at the end of this chapter.

3.3.4.2.3 External validity

There is widespread agreement regarding the definition of external validity in social research. External validity involves establishing the domain to which a study's findings can be generalized, to other populations, settings, or periods (Yin 1994; Ghauri, et al. 1995). External validity is a direct consequence of the research design and may be verified by replication logic, that is, by conducting multiple case studies of other populations, settings, or periods.

Given the multi-case design of this study, assessing the external validity of this study on a limited scale is possible. The proposed framework regarding the decision process for altering a vertical coordination strategy will be applied against cases consisting of industries and individual firms operating in the Michigan seed potato and Michigan celery subsectors. Further adding to the ability to assess the external validity of this study are multiple transaction interfaces which will be studied at each industry and individual level found in this study.

There may be limits to achieving broad external validity in this research. The framework will be applied to three industries (Michigan and Wisconsin seed potato, and the Michigan celery industries) and two separate interfaces (the production-marketing and marketing-buying interfaces). It is hoped the framework will perform well in these industries and interfaces. Ideally, this framework will be robust enough to be applied across multiple industries and interfaces. Even if the framework performs well in the three industries considered in this research, factors unique to these industries may lead to differences in framework performance in other industries, thereby reducing external validity. For example, the decision makers in the Michigan and Wisconsin seed potato and

Michigan celery industries may have significantly different risk preferences than decision makers in other industries which directly affects the risk/return tradeoff of alternative strategies and the willingness or unwillingness of producers to change from one strategy to another.

3.3.4.2.4 Reliability

Reliability of a study is the extent to which different investigators can use the same methods, studying the same phenomenon, can reach approximately the same results (Gummesson, 1991). A study with high reliability can be replicated by others. The emphasis is on doing the same case again, and not on claiming replication by doing another case study using the same methodology.

High reliability in case study research requires the investigator clearly to document the procedures followed in the earlier case. The procedures used to carry out this study will be clearly and concisely identified, including: (1) the secondary sources of data will be referenced whenever applicable, (2) the logic behind the selection of individuals to be interviewed, and, a copy of the interview form will be provided, (3) the process used to disseminate the information obtained (e.g., how pattern matching was carried out) will be laid out in detail, and (4) a detailed description of how the qualitative data was coded into categorical variables used in the statistical analysis will be provided. The question of reliability will be built into the research design of this study.

3.4 Proposed Data Collection Process

The review of the literature gave the investigator: (1) a general knowledge of the competing theories of organizational form (e.g., transaction cost analysis, positive agency theory, and the resource-based theory of the firm), (2) the theoretical grounding necessary to establish the face validity of the proposed framework regarding the decision process for altering a vertical coordination strategy, and (3) background data on the Michigan seed potato and Michigan celery industries, and its decision makers, which will be applied in the case studies.

Earlier in this chapter it was determined the case study method was the primary research strategy. Specific data was needed to understand the unique characteristics of the Michigan seed potato and Michigan celery industries and its decision makers. There were approximately 22 seed potato and 28 celery operations in Michigan at the time this research was undertaken. There are two types of data about industries: published data and data gathered from interviews with industry participants and observers. This research, while using both sources, will rely heavily on data collected from face-to-face and phone interviews with industry participants and observers.

The use of an iterative data collection process is part of the research design and will improve the linking of data to research propositions. Utilizing an iterative process involves pretesting the survey instrument and receiving feedback during data collection to juxtapose preliminary findings against the proposed framework regarding the decision process for altering a vertical coordination decision. These findings will be presented in the next chapter.

The data for this research will be primarily collected from face-to-face interviews, telephone interviews, and will be set against the investigator's business background and past research experience with Michigan seed potato and Michigan celery producers. The data collection process includes: (1) historical data regarding the evolution of the Michigan seed potato and Michigan celery industries (to ascertain the effects of path dependence on decision making), (2) industry-level case studies for the Michigan seed potato and Michigan celery industries that will allow the proposed decision making framework to be scrutinized from the viewpoint of a single "omniscient" industry decision maker (i.e., to test if the proposed framework helps to describe reality), and (3) individual decision maker case studies based on producers from the Michigan seed potato and Michigan celery industries that will enable the proposed decision making framework to be evaluated from the view point of actual decision makers.

The multi-case design of this research creates a unique opportunity to link the data to the research propositions based on decision makers with different "current" strategies along the vertical coordination continuum. For example, most of the Michigan seed potato producers are vertically integrated at the production-marketing interface (they sell their own seed), while the majority of Michigan celery producers are involved in a cooperative at the production-marketing interface which establishes the price for celery. How and why the decision makers of these industries have come to rely on these particular coordination strategies may provide additional insight into the decision making process for altering a vertical coordination strategy.

The remainder of this section is divided into the following subsections: (1) use of a multiple-strata quota sample, (2) the use of a questionnaire as a survey instrument, (3) methodological issues regarding the use of discriminant analysis, and (4) methodological issues regarding the use of logistic regression. The multiple-strata quota sampling method is argued best to capture the breadth of analysis needed in this study, while the use of in-depth interviews based on well planned questionnaires will allow the researcher to better codify the data collected. The use of discriminant analysis and logistic regression will allow quantitative methods to be used to test the four research propositions.

3.4.1 Use of a multiple-strata quota sample

Given the multi-case design of this research, it was believed a multiple-strata, quota sample[25] would lead to better research results than a random sample given: (1) the amount of detailed data needed to test the validity of the proposed framework, (2) the geographic dispersion of seed potato and celery producers in Michigan, and (3) the dynamic nature of the decision process for altering a vertical coordination strategy.

Multi-strata, quota sampling is a search for respondents meeting preselected criteria. For example, representative views will be sought from: (1) small, medium and large seed potato and celery producers, (2) seed potato and celery producers located across various growing areas in Michigan (3) seed potato and celery producers who want to change their current vertical coordination strategy, (4) seed potato and celery producers who are satisfied with their current vertical coordination strategy, and (5) professionals associated with an interest in the long-term health of the Michigan seed potato and Michigan celery industries.

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[25]This definition is taken from a Michigan State University class, AEC 891C: Field Data Collection and Analysis, Summer 1995.

The advantages of using a multi-strata, quota sampling methods include: (1) it is easy to implement, (2) relatively inexpensive versus trying to qualify potential respondents from membership directories, (3) a quick way to reach the broad range of opinions sought, and (4) the best way to capture the knowledge of a representative segment in the population (in this situation, the respective Michigan seed potato and celery industries).

The disadvantages of using a multi-strata, quota sampling methods are: (1) there is no basis to estimate population parameters from sample values, since sampling was not random, and (2) it is likely to result in a biased sample (this would be minimized if appropriate selection criteria and experience are used). However, it is believed, given the objectives of research and use of the case study method in the context of vertical coordination decision making, the advantages of using the multi-strata, quota sampling method outweigh it's disadvantages. For example, given the relatively small size of the seed potato and celery industries in Michigan, the multi-strata sample design allowed the investigator to target specific producers representing various geographic and ideological positions in these industries. In this respect, a conscious effort will be made to include a wide-range of producers to gather information which is truly representative of these industries.

Potential respondents will include: (1) seed potato and celery producers chosen from seed directory lists, (2) seed potato and celery producers who have collaborated with the investigator on past research projects, and (3) professionals associated with the Michigan seed potato and Michigan celery industries. A list of 55 potential respondents has been generated as the target sample for this study.

3.4.2 Questionnaire and face-to-face interview guide as survey instruments

The survey instrument used to gather data for this research will consist of a two-page questionnaire and set of face-to-face questions designed to guide the interview process. These instruments will be administered by the investigator (sole enumerator) via face-to-face and telephone interviews. An effort will be made to conduct as many face-to-face interviews as possible to gather the detailed data needed for the case studies and to find multiple sources of similar data to triangulate information.

The survey instruments are designed to be "conceptually equivalent." In other words, do equivalent "concepts" of the components of the proposed framework exist in the seed potato and celery industries? While the investigator is familiar with costliness of fit, programmability of alternatives, implementability of alternatives, and risk/return tradeoffs, it is unlikely that individuals in the seed potato and celery industries will interpret the concepts and jargon in the intended manner. The researcher will be careful to phrase questions in the questionnaire so that the typical seed potato and celery producer will understand. For example, seed potato and celery producers will be asked "Do you believe effective management routines exist which you could use to aid in the adoption of an alternative vertical coordination strategy?" The "conceptually in-equivalent" form of this question would be "Do you believe alternative vertical coordination strategies are programmable?"

The survey instruments were reviewed by Dr. H. Christopher Peterson, and Dr. Stephen B. Harsh, Firm Management Economists in the Department of Agricultural Economics at Michigan State University. These survey instruments will be pretested on one seed potato and celery producer. Suggestions from these "pre-tests" will be incorporated into the final versions. Copies of the questionnaire and the face-to-face interview guide questions are included in the Appendices.

Once the face-to-face and phone surveys were prepared, approval was sought from the Michigan State University Committee for Research Involving Human Subjects (UCRIHS). Participants will be assured of confidentiality and participation is strictly voluntary. A copy of the letter to be sent to potential respondents can be found in Appendix C.

While the questionnaire was composed of Likert scale and the pair-wise comparison of concept questions, the majority of the questions in the face-to-face interview guide were open-ended. For example, seed potato and celery producers were asked to describe why they were or were not satisfied with their current vertical coordination strategy. The number of closed-ended questions will be limited primarily to demographic questions concerning the age of the decision maker, the ages of other partners, the type of operation and percentage of total farm income generated by vertical coordination strategies at specific transaction interfaces.

Upon completion of the interview stage, answers to the open-ended questions were aggregated and coded based on pattern matching to link the data to the research propositions of the proposed framework regarding the decision process for altering a vertical coordination strategy. These patterns were coded into categorical variables to be used in discriminant analysis.

Face-to face and telephone interviews with seed producers, buyers and interested professionals were scheduled between March 25, 1998 and May 6, 1998. This resulted in a total of 25 completed questionnaires that served as the base line data for the individual case studies and statistical analysis.

3.4.3 Methodological issues regarding the use of discriminant analysis

Discriminant analysis will be used to examine how the variables derived from the interviews are related, and, when the data permit, to assign causality about the decision process for altering a vertical coordination strategy. The reason economists have recognized the importance of qualitative response models such as discriminant analysis is that the models' structures are particularly well suited for examining yes/no choices (e.g., a change or no change in vertical coordination strategy) and/or selections made from a small number of alternatives (e.g., choice of five vertical coordination strategies).

Discriminant analysis will be used for interpreting group differences and classifying cases into groups. Discriminant analysis will be used in this research to study how decision makers who exhibit a unwillingness to change from their current strategy to an alternative, differ from decision makers who exhibit a willingness to change.

Discriminant analysis was developed by Fisher (1936). According to William R. Klecka, University of Cincinnati discriminant analysis is:

> "A statistical technique which allows the researcher to study the differences between two or more groups of objects with respect to several variables simultaneously." p. 7

Discriminant analysis is a broad term which refers to several closely related statistical activities. Discriminant analysis is used for interpreting group differences and classifying cases into groups. The investigator is engaged in interpretation when studying the ways in which groups differ. Discriminant analysis was used in this research to study how decision makers who exhibited a unwillingness to change from their current strategy to an alternative, differed from decision makers who exhibited a willingness to change. The goal for utilizing discriminant analysis is to be able to "discriminate" between these groups based on the factors derived from the proposed framework. Discriminant analysis allowed the identification of the most powerful discriminators.

Discriminant analysis will also be used to derive multiple mathematical equations for classification. Equations called discriminant functions combine group characteristics in a way that will allow one to identify the group (unwillingness or willingness of change) which a case most closely resembles (Klecka 1980: p. 9).

3.4.3.1 Assumptions of discriminant analysis

The characteristics used to distinguish among the groups are called "discriminating variables." These variables are recorded and measured so that means and variances can be calculated, so they can be legitimately employed in mathematical equations. Usually, there is no limit on the number of discriminating variables as long as the total number of cases exceeds the number of variables by more than two.

There are however, some limits on the statistical properties which discriminating variables are allowed to have. First, no variable may be a linear combination of other discriminating variables. A linear combination is the sum of one or more variables which may have been weighted by constant terms. This means one may not use either the sum or the average of several variables, along with all those variables. Two variables which are perfectly correlated cannot be used at the same time. This restriction on linear combinations is based on the mathematical techniques used in discriminant analysis, but it also makes intuitive sense. The variable defined by the linear combination does not contain any new information beyond what is contained in the components, so it is redundant.

Another assumption of discriminant analysis is that the population covariance matrices are equal for each group being analyzed (i.e., unwillingness and willingness of change). The statistical method used in SPSS (the statistical package used by the investigator) for testing the equality of the group covariance matrices is the Box's M test.

The final assumption required for valid discriminant analysis results is that each group be drawn from a population which has a multivariate normal distribution. Multivariate normality permits the precise computation of tests of significance and probabilities of group membership (Klecka 1980: p. 10). The assumption of multivariate normality is crucial in for determining which variables will be allowed to enter and remain in the final model. Given the likelihood of a small sample size and the predominance of categorical discriminating (independent) variables, satisfying the multivariate normality assumption may be difficult. However, useful information may be obtained even if the assumption of multivariate normality fails.

3.4.3.2 Concluding remarks regarding the use of discriminant analysis

The basic steps of discriminant analysis are: (1) the selection of variables which are hypothesized to have the greatest power for group classification, (2) selection of cases (from in-depth interviews with Michigan celery and seed potato producers) which will be used in the computation of the discriminant function, (3) conducting the test to uncover the explanatory power of the variables, (4) refining the variables selected by eliminating those variables which are not statistically significant (based on the F-test) and dropping them from the analysis, (5) evaluation of the estimated function which involves evaluating the contribution of different factors to the estimated function, accuracy of the estimated function, and whether the basic research propositions hold up, and (6) using the estimated function for predicting membership of new observations.

3.4.4 Methodological issues regarding the use of logistic regression

Some authors call the general model *linear regression* and the dichotomous model as *logistic regression*. In a logistic regression, the dependent variable has the value of 1 if the event occurs, or the choice is selected; the variable has a value of zero if the event does not occur or if the choice is not selected[26]. For applications of the framework in this research, the dichotomous dependent variable takes on the value of 1 when the respondent exhibits a willingness to change from a current strategy and a value of zero when the respondent exhibits an unwillingness of changing from a current strategy to an alternative strategy.

In logistic regression, you directly estimate the probability of an event occurring. For the case of a single independent variable, the logistic regression model can be written as $Prob(event)=\frac{1}{1+e^{-(B_0+B_1X)}}$ where B_0 and B_1 are coefficients estimated from the data, X is the independent variable, and e is the base of the natural logarithms, approximately 2.718. For more than one independent variable, the model can be written as $Prob(event)=\frac{e^{z}}{1+e^{-z}}$ where Z is the linear combination $Z+ B_0 + B_1X_1 + B_2X_2+\ldots+$

[26]As Amemiya notes, the dependent variable can be assigned any two integer values. However, the use of zero and one have particular advantages in the mathematical and statistical development of the models, and are almost universally used.

B_nX_n. The probability of the event not occurring is estimated as Prob (no event) = 1 - Prob (event).

3.4.4.1 Logit Models using the Maximum Likelihood Estimator

In logistic regression, the parameters of the model are estimated using the maximum likelihood method. Here the coefficients which make the observed results most "likely" are selected. Since the logistic regression model is nonlinear, and iterative algorithm is necessary for parameter estimation (Norusis 1994: p. 3).

The maximum likelihood estimator is one of the most common approaches used for estimating beta, the vector of parameters in an econometric model. Kennedy summarizes the basis for the maximum likelihood estimator as "the idea that the sample of data here is more likely to have come from a 'real world' characterized by one set of parameter values than from a 'real world' characterized by any other set of parameter values. The maximum likelihood estimate (MLE) of a vector of parameter values β is simply the particular vector β^{MLE} that gives the greatest probability of obtaining the observed date (p. 21)." In other words, β^{MLE} is the value of β that maximizes the probability of drawing the data set that was actually attained during the data collection (Sterns 1997: p. 221).

Other than its high computational demands, the maximum likelihood estimator is a "good" estimator in that it produces consistent, efficient and asymptotically normal estimators. By definition, the maximum likelihood estimator, β^{MLE} is the value of beta that maximizes the Likelihood Function (or the natural logarithm of the Likelihood Function). Differentiating the natural logarithm of the Likelihood Function with respect to beta, and then setting this column vector of derivatives equal to zero and solving for beta generates β^{MLE}.

3.4.4.2 *The base logistic regression model*

The dependent variable: As was noted above, the dependent variable is a univariate, dichotomous variable that has the value of 1 when the respondent shows a willingness to change strategy and a value of 0 when the respondent exhibits an unwillingness to change from a current strategy to an alternative.

The independent variables: Independent variables for the base model will be either taken directly from interview questions or developed from some combination and/or manipulation of interview questions.

Summarizing the base model in general terms of regression analysis: for more than one independent variable, the model can be written as $Prob(willingness) = \frac{e^{z}}{1+e^{-z}}$ where Z is the linear combination Z+ $B_0 + B_1X_1 + B_2X_2 + \ldots + B_nX_n$. The probability of an unwillingness to change strategy is estimated as Prob (unwillingness) = 1 - Prob (willingness).

3.4.4.3 *Logistic regression diagnostics*

When the assumptions of logistic regression are violated, calculation of a logistic regression model may result in one of three problematic effects: biased coefficients, inefficient estimates, or invalid statistical inferences. Bias refers to the existence of a systematic tendency for the estimated logistic regression coefficients to be too high or too low, too far from zero or too close to zero, compared to the true values of the coefficients. Inefficiency refers to the tendency of the coefficients to have large standard errors compared with the size of the coefficient. This makes it more difficult to reject the null hypothesis (the hypothesis that there is no relationship between the dependent variable and the independent variable) even when the null hypothesis is false. Invalid statistical inference refers to the situation in which the calculated statistical significance of the logistic regression coefficients is inaccurate (Menard 1995: p.58).

The first and most important assumption in both linear and logistic regression analysis is that the model is specified correctly. Correct specification has two components: (1) the functional form of the model is correct, and (2) the model includes all relevant independent variables and no irrelevant independent variables.

Multicollinearity is a problem that arises when independent variables are correlated with one another. When perfect collinearity exists (at least one independent variable is a perfect linear combination of the others), it is impossible to obtain a unique estimate of the regression coefficients. While perfect collinearity is rare, less than perfect collinearity is common. Any correlation among the independent variables suggests collinearity.

When collinearity exists, it does not necessarily indicate that there is anything wrong with the model or the theory underlying the model. Instead, problems arise because of empirical patterns in the data. There are two related problems which are particularly relevant to the small sample size used in this research: zero cell count and complete separation. Zero cell count occurs when the dependent variable is invariant for one or more or more values of a categorical independent variable.

If one is too successful in predicting the dependent variable with a set of predictors, the problem is one of complete separation. Both the logistic regression coefficients and their standard errors will tend to be extremely large. If separation is less complete (called quasicomplete separation), logistic regression coefficients and their standard errors will also be extremely large.

3.4.4.4 *Concluding remarks regarding the use of logistic regression*

Most econometric models use dependent variables that are continuous in nature (e.g., yields, earnings, price-quantities). However, some research questions such as those posed here lend themselves more readily to a limited number of fixed, discrete responses. In these cases, the discrete responses are modeled as qualitative dependent variables, and specific econometric modeling and regression analyses such as logistic regression are needed that accommodate the statistical limits of having a dependent variable that is not continuous.

3.5 Concluding Remarks Regarding Research Propositions, Research Strategies, and the Data Collection Process

An effective research methodology consists of making decisions regarding the choice of research epistemology, research strategy, and research design. Epistemology is the study of how people know what they know. Specifically, investigators must choose from a research epistemology based on positivistic knowledge or phenomenological knowledge. The phenomenological knowledge-based approach to research epistemology was chosen for the following reasons: (1) theoretical development surrounding the investigation of the vertical coordination decision making process is in its infancy (i.e., this research is theory-building in nature versus theory-disconfirming), (2) the process of decision making is not easily separated from influence of the environment on the decision making process, (3) the factors affecting the vertical coordination decision process are not easily quantifiable, and (4) the underlying structure regarding choice of vertical coordination strategy is changing dramatically.

Case study research was identified as the research strategy best suited to carry out the objectives of this research. This research is explanatory in that it seeks to explain the dynamic nature of the decision process for altering a vertical coordination strategy. Case study research involves a detailed examination of relatively few persons, items, or entities. Case research is defined in this study as the qualitative and field-based construction of case studies.

The case method of research makes sense for analyzing the choice of vertical coordination strategy in the Michigan seed potato and celery industries for three reasons: (1) the relatively small number of producers in their respective Michigan industries makes it easier to draw industry-wide conclusions based on a limited number of detailed observations, (2) the complexity of the decision process for altering a vertical coordination strategy requires in-depth study and analysis to understand the dynamics present, and (3) the case study findings will allow agricultural decision makers in other industries to adapt specific parts of this analysis to their individual circumstances.

A research design is a plan that guides the investigator in the process of collecting, analyzing, and interpreting observations. The main purpose of the research design is to help avoid the situation in which the evidence does not address the initial research problem. The components of the case study research design include: a study's questions, its propositions, the unit(s) of analysis, the logic linking data to the propositions, and the criteria for interpreting the findings.

The four research propositions presented earlier in this chapter, may lend themselves to the creation of propositions which can be tested by linking the data to the propositions by using a pattern matching technique common in case study research. The research propositions may also lend themselves to statistical testing techniques, including chi-square statistics, discriminant analysis, and logistic regression.

This research will employ a multi-case design because of: (1) the theory-building nature of this research, (2) the need to create a generalizable model that better explains the decision process for altering a vertical coordination strategy, and (3) the availability of logical subunits of analysis. Precautions will continue to be taken, to preserve the construct validity, internal validity, external validity, and the reliability as the criteria for judging the quality of this research design.

Data collection will be carried out through an iterative process to reduce researcher bias and to avoid potential blind spots associated with case study research methodology. In-depth face-to-face and telephone interviews will be used to administer a questionnaire across a multi-strata sample of Michigan seed potato and Michigan celery producers and interested industry professionals knowledgeable in matters pertaining to these industries. A detailed explanation of the research findings are presented in Chapter 4 and Chapter 5.

CHAPTER 4
INDUSTRY-BASED RESEARCH FINDINGS

This research undertook four industry-based case studies within the Michigan seed potato industry, the Wisconsin seed potato industry, and the Michigan celery industry. For each case, the analysis based on the decision process framework for altering a vertical coordination strategy has been written from the perspective of an "omniscient" industry-level decision maker rather than from the perspective of individual firms. This decision maker can identify the factors leading to the dominant forms of vertical coordination strategy for each industry.

This chapter is divided into four main parts. The four sections of this chapter were chosen to point out the key industry findings and to use the framework to explain strategy differences between selected firms in a particular industry. First, general descriptions of the strategies being employed at the four interfaces of the Michigan and Wisconsin seed potato industries and of the Michigan celery industry are presented. This section illustrates the surprising number of competing vertical coordination strategies which are employed at these interfaces within these industries. Second, the primary vertical coordination differences between the Wisconsin seed potato producers and the Michigan seed potato producers are highlighted and offered as a partial explanation for the apparent performance differences between these two industries. Third, the differences in strategy selection between average Michigan celery producers and large western vegetable grower/shippers are also explained using the proposed framework. Finally, the framework will be used to explain the strategies a large consumer foods company (Frito Lay) has chosen at the four transaction interfaces. The influence of Frito Lay on the Michigan and Wisconsin seed potato value chains[27] and its influence on producers' choice of strategy selection is discussed. An overview of the four transaction interfaces in the Michigan and Wisconsin seed potato industries will be given before an overview of the four transaction interfaces in the Michigan celery industry.

4.1 Overview of the Four Transaction Interfaces in the Michigan and Wisconsin Seed Potato Industries

When the industry-based analysis was in its early stages, the investigators believed the proposed framework would accomplish at least two things: (1) describe the reality of strategy choices in each of the three industries as to the four decision nodes, and (2) suggest a dominant industry-wide vertical coordination strategy based on industry levels of the variables relevant to the four decision nodes. Although the proposed framework was well suited to describing the existence of various strategies, what became apparent as the industry analysis progressed was that firm-level differences among the relevant variables made an industry analysis difficult to achieve. For example, concepts such as competitive advantage (a key component of nonseparability, and therefore of the

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[27]The value chain concept was pioneered by Michael Porter (1985) and is based on the assumption that a business' basic purpose is to create value for users of its products or services. In a value chain, decision makers divide the activities of their business into sets of separate activities that add value. Their firm is viewed as a chain of value-creating activities starting with procuring raw material or inputs and continuing through design, component production, manufacturing and assembly, distribution, sales, delivery, and support of the ultimate user of its products or services.

costliness of a coordination error) can vary from firm to firm and contribute to the existence of different strategies.

The industry-based analysis did reveal that the proposed framework was useful in explaining the wide variety of coordination strategies present within each industry. The differences between the Michigan and Wisconsin seed potato industries are highlighted in this section. Given the similarities between these industries and the desire to limit the reporting redundance, the four transaction interfaces in the Michigan and Wisconsin seed potato industries are presented together. Figure 4.1 and Figure 4.2 illustrate the four transaction interfaces studied which are labeled as: (1) the genetics-tissue culture interface, (2) the tissue culture-seed production interface, (3) the seed production-marketing interface, and (4) the marketing-buying interface. Key characteristics, including the common vertical coordination strategies employed at these interfaces, are presented below.

4.1.1 The genetics-tissue culture production interface in the Michigan and Wisconsin seed potato industries

In these industries, genetic advancements are the responsibility of university plant breeders, private plant breeders (companies with their own plant breeders such as Frito Lay), the Michigan Seed Potato Association, the Wisconsin Seed Potato Improvement Association, private tissue culture seed labs, and state run seed farms (e.g., the Wisconsin State Seed Farm).

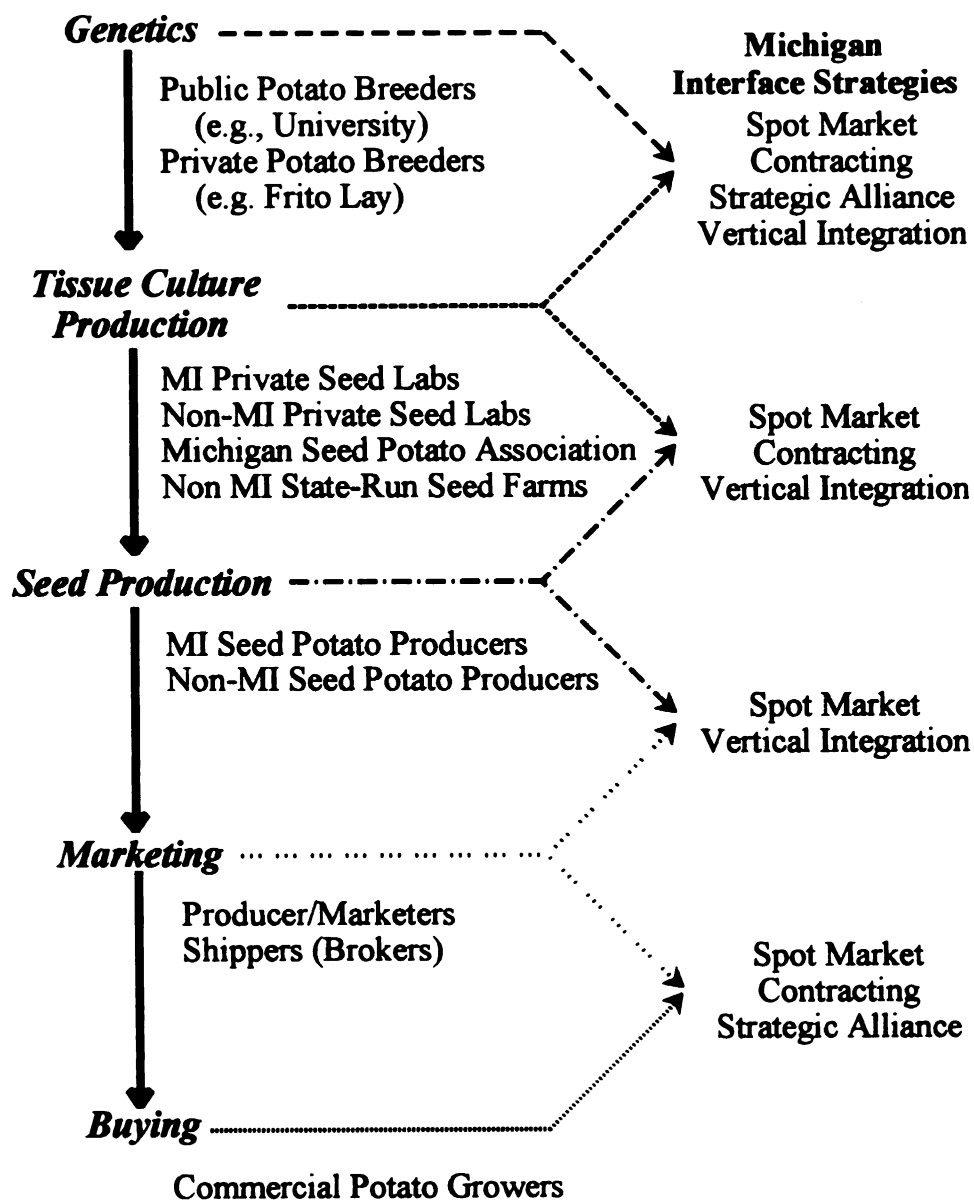
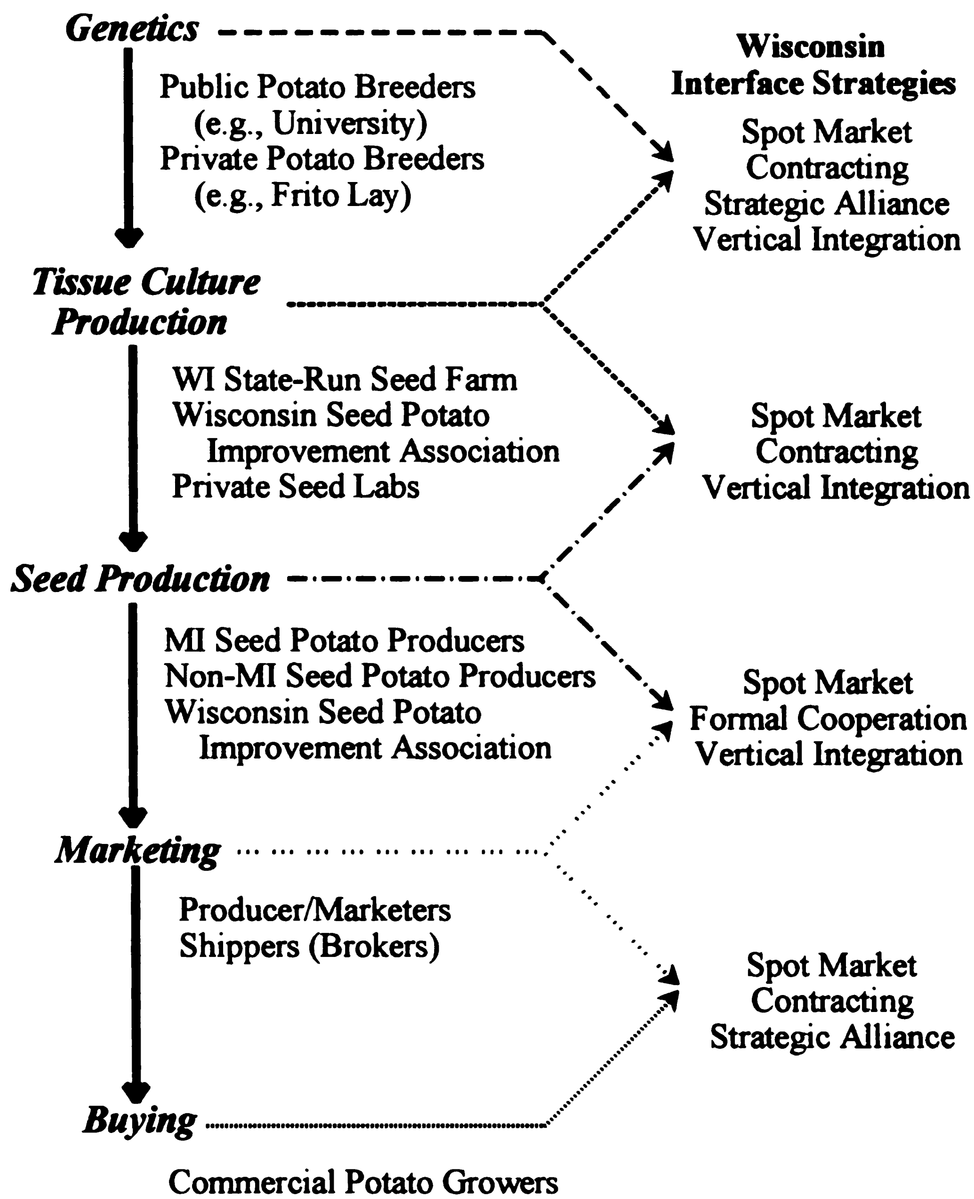


Figure 4.1 The Michigan Seed Potato Value Chain



Figure`4.2 The Wisconsin Seed Potato Value Chain

Varietal advancements of both public and private seed potato plant breeders are planted in test plots in Michigan and Wisconsin commercial potato producers' fields. These test plots are evaluated and the most promising varieties are then propagated or grown out by the private tissue culture labs in Michigan or the State Seed Farm in Wisconsin and then sold to seed potato producers to be further propagated and eventually sold to commercial potato growers. The current vertical coordination strategies utilized at the genetics-tissue culture production interface are the same for the Michigan and Wisconsin seed potato industries: (1) spot market, (2) specification contracting, (3) strategic alliance, and (4) vertical integration (see Figure 4.1 and Figure 4.2).

Spot market relationships exist between: (1) university potato breeders and the private tissue culture labs, and (2) university potato breeders and out of state seed farms. Specification contracting is common between private potato breeders and private seed labs. These parties usually serve the chipping potato industry. One consumer food company (Frito Lay), besides relying on specification contracting, is also integrated at the genetics-tissue culture production interface. They own in-house plant breeders and tissue culture labs. Operationally, the interaction between the potato plant breeders at the University of Wisconsin and the state seed farm is vertical integration. All genetic advancements made by university breeders most go through the state seed farm initially. This is a good example of institutional acceptability since the Wisconsin potato breeder do not even consider offering new varieties to tissue culture labs and seed potato producers in states other than Wisconsin until after the state seed farm and Wisconsin seed potato producers have decided they do not want a particular variety, the plant breeder is free to seek alternative strategies. This institutional acceptability is governed by tradition as it is by the vertical integration of the university breeders and state seed farm.

Michigan and Wisconsin seed potato producers are involved in genetics via strategic alliances. Michigan and Wisconsin seed potato producers belong to separate seed improvement associations, where they serve an advisory role (regarding varietal advancement) to the public plant breeders, state seed farms, and private seed labs. Few, if any of the Michigan and Wisconsin seed potato producers are vertically integrated back into the basic genetics of seed potato production.

4.1.2 The tissue culture production-seed potato production interface in the Michigan and Wisconsin seed potato industries

The primary vertical coordination strategies employed at the tissue culture production-seed production interface are spot markets, contracts, and vertical integration. Michigan and Wisconsin seed potato producers are free to purchase their genetic material from private seed labs and state run seed farms respectively. Most of these arrangements are based on quasi-spot markets in the sense that traditionally, the price for a seed producers' seed was consistent across all the private seed labs (access to this seed is an entirely different matter), and state seed farms. This may begin to change as more of the newly released seed potato varieties incorporate transgenic genes which are likely to create an explosion of differentiated genetic material to choose from.

Specification contracting is common at the tissue culture-seed production interface in the Michigan and Wisconsin seed potato industries, especially between companies serving the needs of the potato chip industry. A limited number (two in Michigan) of seed potato producers are integrated back into the tissue culture production. The potato chip processors have traditionally not been involved in direct seed production, but have opted for control over the genetics used in the growing of seed potatoes via contracts.

Contracts have been gaining in popularity and prominence in the seed potato industries. A seed potato producer and tissue culture lab may be willing to accept the expected returns of a long term contractual relationship in exchange for the reduced risk and increased ability to plan their businesses over a longer time horizon (to reduce uncertainty). This increase has been driven in large part by the large potato chip companies who have contracted for years with commercial producers. These commercial producers occasionally put pressure on their seed suppliers to contract, who in turn put pressure on tissue culture labs to contract.

Institutional acceptability may have been the most important factor influencing choice of vertical coordination strategy at this interface for the Michigan and Wisconsin seed potato industries. University potato breeders felt obligated to provide genetic material to their home state first. While, seed producers felt obligated to support their home-state potato breeding programs whenever possible. This institutional constraint is unwritten and it allows spot market forms of vertical coordination to act like contracts and strategic alliances. This reduces the costliness of a coordination error that occurs under conditions of increasing asset specificity and nonseparability, characteristic of this interface in the Wisconsin and Michigan seed potato industries.

It is interesting that university breeders did not always feel as obligated to their own states as they do now. In the past, a larger portion of a potato breeder's research money came from federal funds. With these funds came the implicit and even explicit need to serve the entire U.S. potato industry. The following changes occurred which have contributed toward serving the needs of the university breeder's state first: (1) federal funds have dwindled, (2) the relative importance of state funding has increased, (3) older potato plant breeders are retiring and being replaced by younger plant breeders who are building research programs based primarily on state funds, and (4) the increasing uses of biotechnology and patent protection is forcing increased accountability of seed potato breeding programs.

The changing nature of agriculture, and in particular, changes in plant variety protection and biotechnology are likely to result in increased levels of asset specificity and nonseparability, which raises the costliness of a coordination error. Institutional acceptability is a key component at the first two interfaces because it allows spot markets to operate more like contracts and strategic alliances which are better matched strategies than spot markets when the costliness of a coordination error increases.

4.1.3 The production-marketing interface in the Michigan and Wisconsin seed potato industries

There is a distinct difference between the most commonly utilized vertical coordination strategies at the production-marketing interface within the Michigan and Wisconsin seed potato industries. The common vertical coordination strategies employed at this interface in the Michigan seed potato industry are spot markets and vertical integration, while Wisconsin seed potato producers employ spot markets, vertical integration, and formal cooperation at this interface.

Once the seed has been advanced a minimum of two cycles or generations, it is ready to be marketed. Some seed producers choose to sell their seed to commercial potato growers via seed potato brokers, while others prefer to sell directly to the commercial potato growers. Most of the Michigan and Wisconsin seed potato producers sell their own seed, bypassing the broker (vertical integration) at this interface during the last ten years.

Formal cooperation at this interface in the Wisconsin seed potato industry is defined by seed producers who work together to "market" their industry relative to other seed potato growing areas. The Wisconsin seed potato producers meet occasionally as a group to discuss marketing issues. However, formal cooperation for this industry does not mean that Wisconsin seed potato producers belong to an organization that sells the seed for the individual members. The use of formal cooperation in the Wisconsin seed potato industry, and its lack of use in the Michigan seed potato industry is the one observable difference in strategies between these two industries. This difference is argued to be a critical factor linked to differences in performance between Michigan and Wisconsin seed potato producers, and as such, is discussed in a separate section in this chapter.

4.1.4 The marketing-buying interface in the Michigan and Wisconsin seed potato industries

Spot markets, contracting, and strategic alliances form the dominant vertical coordination strategies employed at the marketing-buying interface (see Figure 4.1 and Figure 4.2) within the Michigan and Wisconsin seed potato industries.

The current dominant vertical coordination strategy by Michigan and Wisconsin seed potato producers at the marketing-buying interface was spot market, followed by an occasional specification contract. That is, most seed marketers choose to sell their seed to commercial potato growers via the spot market, trying to get as much for their seed as possible, while a few seed producer/marketers have established multi-year seed contracts with commercial potato growers.

A growing number of seed producers are entering strategic alliances with selected buyers. For example, one Michigan seed producer has established a relationship with a seed potato buyer based on trust and a free exchange of information. The seed producer is intimately involved in how well his seed varieties are performing for the buyer. The seed producer has access to information on how seed from other seed producers is performing for the buyer as well. Seed prices are set at least a year in advance and are based on a firm hand shake, not on a signed document.

4.2 The Michigan and Wisconsin Seed Potato Industries: Formal Cooperation and the Role of Compatibility

This section focuses on the one difference in strategy selection between the Michigan and Wisconsin seed potato producers. Formal cooperation at the seed production-marketing interface was identified as the only difference in choice of strategy, at any interface, between these seed potato industries. Michigan seed potato producers have stated their belief that the Wisconsin seed industry has been doing better than the Michigan industry the last ten years. For example, Wisconsin seed potato producers are more aggressive in their marketing efforts, they tend to be larger in size, and they continue to receive more for their seed than Michigan seed potato producers. Perhaps the use of formal cooperation by Wisconsin seed potato producers can offer some insights. A few introductory comments are provided, which are followed by a summary of the responses Michigan seed producers offered during the interview process regarding a follow up question related to the 1993 Michigan seed potato strategic plan.

Compatibility between Michigan seed producers is moderate to low. Although, Michigan seed potato producers share much in terms of cultural compatibility, the day-to-day competitive interaction and differing approaches to marketing of seed can lead to a refusal of seed producers to work cooperatively. This reluctance to work together, limits the implementability of formal cooperation and strategic alliances between seed producers as alternative vertical coordination strategies.

Wisconsin seed potato producers face many of these same day-to-day problems between growers. However, they have managed to do a better job of putting aside their differences long enough to engage in cooperative marketing of Wisconsin seed potatoes. While both Michigan and Wisconsin have seed improvement associations, one of the primary functions of the Wisconsin Seed Potato Improvement Association is to work cooperatively in the marketing of Wisconsin seed potatoes. One could argue that compatibility among Wisconsin seed producers is much higher than the compatibility among Michigan seed producers at the production-marketing interface.

4.2.1 Follow-up on the 1993 Michigan seed potato strategic plan

This research allowed the investigator to ask Michigan seed potato producers many follow-up questions regarding a 1993 strategic plan (Wysocki 1997) which was conducted by the Department of Agricultural Economics at Michigan State University. One of the primary recommendations of the proposed strategic plan was the:

> "**Establishment of a common marketing association** to: (1) control seed supplies, thereby managing seed prices, (2) provide an effective means of competing against aggressive proprietary field seed firms and neighboring seed potato producing states, (3) encourage managed growth of the Michigan public variety field seed and seed potato industries, (4) encourage the sharing of technology and information, (5)

> provide a forum where diverse competitors can learn from one another, and (6) increase involvement and visibility in their respective seed industries." p. 110

Initially, this recommendation was met with strong approval from the board of directors of the Michigan Crop Improvement Association (the organization which funded the strategic planning study).

The recommendation listed above was a call for a change in strategy at the producer-marketing interface for an entire industry. The follow-up questions were designed to gain insight into why, after five years, the industry had made little progress toward the establishment of any common marketing association. These follow-up questions were asked at the end of the interview with seed potato producers, since the primary focus of this research was to identify the decision process for altering a vertical coordination strategy on an individual producer basis. The investigator's rapport with the seed potato producers and his desire to frame these questions as an opportunity for learning and not as an opportunity to pass judgement on the Michigan seed potato industry resulted in many candid responses. These findings and their relevance to the current research are presented below.

No one thing is preventing more cooperation at the industry level in the Michigan seed potato industry. Barriers to adoption of increased cooperation on an industry-wide basis can be summarized as:

- Geographic dispersion of Michigan seed potato producers
- Diverging, and sometimes conflicting business strategies, and capabilities
- History of non cooperation and path dependence
- The seed industry has not weakened to a critical level yet
- Risk/return considerations

Geographic dispersion across the state of Michigan contributes to the lack of cooperation. Upper Michigan seed potato growers are actually closer to the Wisconsin seed potato growing area than they are to the lower Michigan seed potato producing areas. The investigator found it striking to hear Upper Michigan seed potato producers talk about the seed industry without any mention of Lower Michigan producers. This lack of acknowledgment should not be interpreted as a conscious act, but as views which are held on a subconscious level. This is due in part to the geographic dispersion and seed variety differences. Most of the Upper Michigan seed potato producers raise russet varieties of seed potatoes, while most of the lower Michigan seed potato producers grow round white varieties of seed potatoes. Russets and whites are usually marketed to different buyers, which leads to widening the gap between geographic seed producing areas in Michigan. Wisconsin seed potato producers are considerable less geographically dispersed than the Michigan seed potato producers. However, both Michigan and Wisconsin seed potato producers grow a wide-range of seed potato varieties.

Across the Michigan seed potato industry, Michigan seed potato producers exhibit different business philosophies. For example, some producers work hard at differentiating their products and services, while other focus on being a low-cost seed producer. Many seed potato producers classified the average seed potato producers as an independent personality. One producer told of how a number of area seed potato producers have decided to combine their chemical orders to take advantage of economies of scale. There is still one area seed potato producer who will not pool his order with the rest of the area producers. While Wisconsin seed potato producers also exhibit different business philosophies, they do find ways to work together or tolerate their differences.

Many Michigan seed potato producers were not able to look past their own self interests. Some producers labeled this behavior as shortsightedness by their fellow seed producers. Overall, the Michigan seed potato industry has been slow to change. As one producer put it "Seed growers just have not recognized the importance of working together yet." Another producer when asked what needs to happen in the Michigan seed potato industry had this to say: "The seed industry needs more cooperation in general, let alone a common marketing association. Perhaps the Upper Michigan growers should work as a unit and Lower Michigan growers as another unit."

Unfortunately, there was a history of non cooperation in the Michigan seed potato industry. Path dependence, as presented in Chapter 2, is prevalent as past failures have led to the reinforcement of non cooperation. One result of failed past attempts at cooperation are bad feelings between neighboring producers and this really bothers some producers to the point where they tell themselves the potential downside of cooperation is not worth it. Often it is all too easy for individual producers to deviate from prearranged cooperative agreements. Buyers know how to encourage this deviation (divide and conquer). This history of failures reinforces this path dependence, leading to a cycle which is difficult to break.

A number of producers stated they just do not trust each other because of past business dealings. Still other producers said industry leaders had become hesitant of sharing too much information (free rider problem). Industry leaders have been heard to say they are tired of trying to drag the rest of the industry along toward cooperation. Unfortunately, industry-wide cooperation usually only happens when there are few alternatives left in the marketplace. The long history of involvement in the Wisconsin Seed Potato Improvement Association by every Wisconsin seed potato producer (membership is voluntary, but all seed producers belong) is likely to have created a method for Wisconsin seed potato producers to build a level of trust which appears to be lacking in the Michigan seed potato industry.

All of these above factors: geographic dispersion of Michigan seed potato producers, diverging, and sometimes conflicting business strategies, and capabilities, a history of non cooperation and path dependence, the seed industry has not weakened to a critical level yet, and risk/return considerations help explain that the process of selecting an alternative strategy based on a common marketing association has been determined at node three, implementability of an alternative strategy.

To be fair to the power of the proposed framework, the risk/return tradeoff must also be addressed regarding industry-wide cooperation. The 1993 Michigan seed potato strategic plan did not directly address the risk/return tradeoff associated with a common marketing association. Indirectly, the risk of non-cooperation and likelihood of expected lowered profits was stated as probable industry outcomes if nothing cooperative was attempted. The point is, if a more tangible risk/return argument had been made (in favor of adopting the common marketing association), perhaps the industry as a whole, would have been more willing to find ways to work cooperatively. However, none of the thirteen seed potato producers ever mentioned the risk/return tradeoff when stating their reasons why little industry-wide cooperation has taken place. In addition, the model does indicate that a no at any one decision node (in this case implementability) is enough to derail the process of altering a vertical coordination strategy.

There are some signs of the industry beginning to work together. The formation of a for-profit corporation is being planned. This organization will consist of Michigan seed potato producers with a goal of advancing seed potato genetics in Michigan. In part, this is a response to a recent change in the Plant Variety Protection Act which now includes potatoes and has thus changed the institutional acceptability of cooperation. This organization will have responsibility for collecting royalties on any new varieties coming out of the Michigan State University breeding program.

4.2.2 Concluding remarks regarding formal cooperation and compatibility in the Michigan and Wisconsin seed potato industries

It has been widely recognized by Michigan seed potato producers that Wisconsin seed potato producers have performed better than their counterparts in Michigan. While specific profit and loss statements were not made available to the investigator, many Michigan seed potato producers indicated their belief that Wisconsin seed potato producers were on average more profitable than they were. Besides financial performance differences, it was possible to observe differences in marketing aggressiveness between Wisconsin seed potato producers who tend to be more aggressive than Michigan seed potato producers. For example, the investigator attended an annual Michigan potato field day recently and discovered there were more Wisconsin seed potato producers at the field day than there were Michigan seed potato producers. Wisconsin seed potato producers are also larger than Michigan producers (150 acres versus 75 acres per seed potato farm on average) which helps the Wisconsin seed potato producers reach economies of scale.

Michigan and Wisconsin seed potato producers face similar costliness of coordination errors. Based on the findings of this study, the levels of asset specificity and nonseparability are similar in the two industries. Michigan seed potato producers' unwillingness to work more cooperatively leaves them vulnerable to higher costs of coordination errors than their Wisconsin counterparts.

4.3 An Overview of the Four Transaction Interfaces in the Michigan Celery Industry

Beyond describing the predominant strategies taking place at the four transaction interfaces in the Michigan celery industry, this section will highlight the differences in strategies between Michigan celery producers and their larger western counterparts. The proposed framework will be used to explain these differences whenever possible.

The four transaction interfaces in the Michigan celery industry are presented in Figure 4.3. These four are: (1) the genetics-celery seed production interface, (2) the celery seed production-commercial celery production interface (3) the commercial celery production-marketing interface, and (4) the marketing-buying interface. Key characteristics, including the common vertical coordination strategies employed at these interfaces, are presented below.

4.3.1 The genetics-celery seed production interface in the Michigan celery industry

The common vertical coordination strategies used in the Michigan celery industry include spot markets, strategic alliances, formal cooperation and vertical integration. In the Michigan celery industry, genetic advancement is the responsibility of university plant breeders, privately held seed companies with their own plant breeders, and a consortium of celery growers, plant breeders and other interested professionals associated with the Michigan celery industry.

The consortium is organized under the name of Celery Research, Inc. (a type of formal cooperation) and is funded by contributions of Michigan celery producers through a voluntary checkoff. Not all Michigan celery producers contribute, while all receive benefit from the consortium's efforts. Celery Research, Inc. promotes genetic

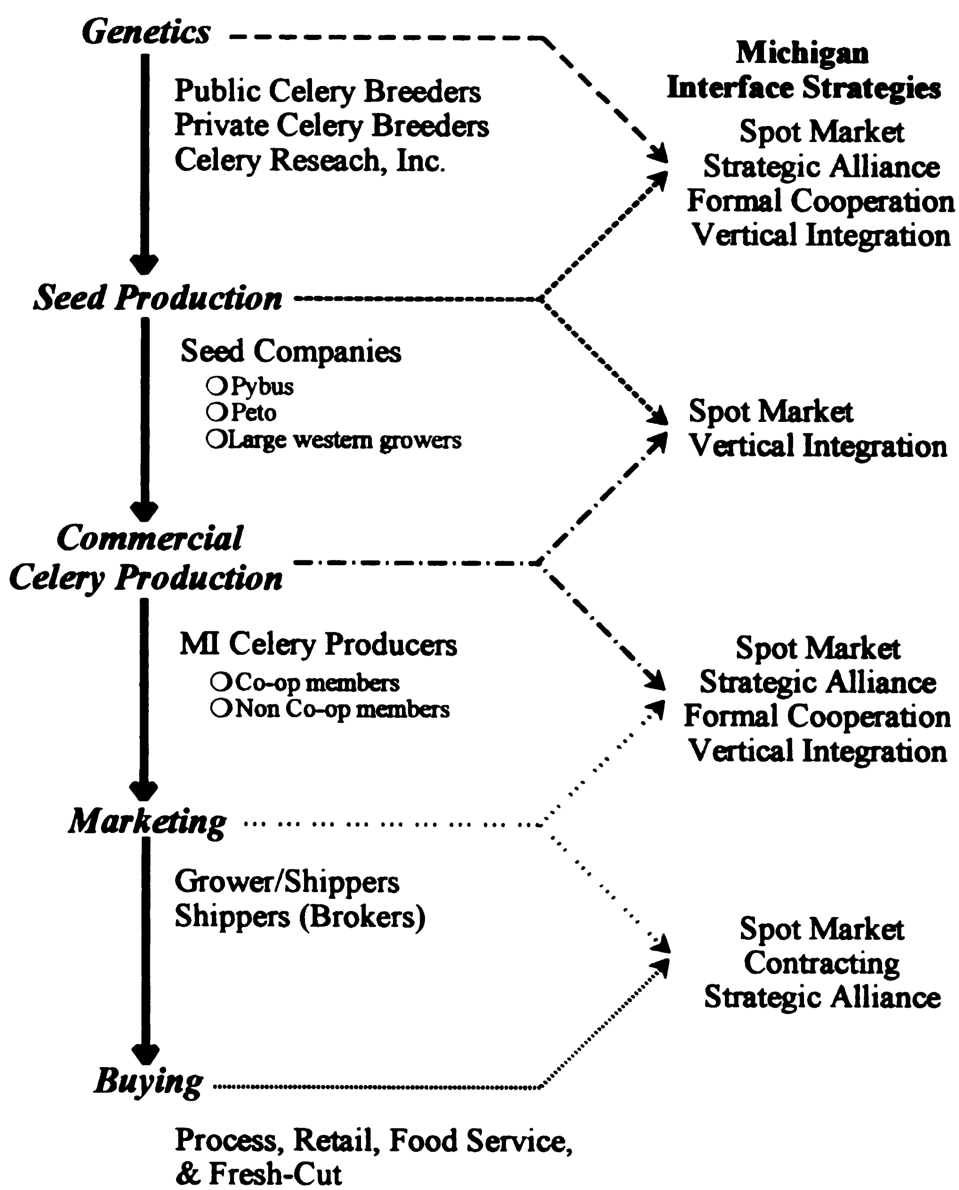


Figure 4.3 The Michigan Celery Value Chain

advancements by coordinating the efforts of public (university) and private (seed companies) celery plant breeders and the celery producers of Michigan (a kind of loose strategic alliance).

Varietal advancements of both public and private celery plant breeders are planted in test plots in Michigan celery producers' fields. These test plots are evaluated and the most promising varieties are then propagated or grown out by the private seed companies and then sold to Michigan celery producers to be used in commercial celery production.

4.3.1.1 Western growers, genetic advancement, and celery seed production

It should be noted that a few of the large western vegetable growers have vertically integrated at the genetics/seed production-commercial celery production interfaces. These growers raise thousands of acres of celery. One grower reported having developed more than eighty of his own celery varieties in-house as a way to match specific varieties to their growing areas and seasons in order better to serve their customers' needs.

This is an example of a firm which believes that nonseparability is high throughout the celery value chain. This high nonseparability is driven by a need to maintain a competitive advantage (varieties tailored to specific growing and customer needs) and a desire to be responsive to the ultimate consumer. If a grower is large enough (e.g., more than 1000 acres of celery) they can probably take advantage of economies of scale in genetic advancement and seed production. In essence, the costliness of fit is acceptable for these vertically integrated western grower/shippers who are vertically integrated at the genetics-celery seed production and celery seed production-commercial celery production interfaces.

These large western producers have overcome any programmability and implementability problems associated with genetics and celery seed production. One large grower indicated the risk/return tradeoff associated with genetic advancement and celery seed production was very acceptable, given the gain in competitive advantage obtained by vertical integration at this interface.

4.3.2 The celery seed production-commercial celery production interface in the Michigan celery industry

The celery seed production-commercial celery production interface in the Michigan celery industry is characterized by spot market relationships with two seed distribution companies who source their seed from two primary seed companies called Peto and Pybus. Michigan State University has a celery breeder who conducts test plots in cooperation with Michigan celery producers and the two seed companies. Any promising Michigan State University celery varieties are released through one or both of the seed companies. There has been a good working relationship between Michigan celery producers and the two seed companies. Celery is a minor crop for these seed companies and the celery producers know this and are happy they have at least two seed companies from which to choose.

One might argue that the increased asset specificity required by taking on the genetics and seed production of celery would lead to an unacceptable costliness of a coordination error. When asked why Michigan celery producers do not vertically integrate into celery genetics and/or celery seed production, the most cited responses were: (1) celery is a biennial, which means it takes two growing cycles before any seed is produced, (2) the cost of celery seed, relative to other inputs such as fertilizer and chemical is minor, (3) most celery producers felt they did not have enough expertise with plant breeding and seed production, and (4) the average size of a Michigan celery producer was too small to justify this expense. There are programmability problems for an average celery producer, since they would have a lot to learn regarding the management routines associated with celery genetics and seed production. Capital (a component of implementability) could become constraining if entering into celery genetics and seed production meant additional greenhouses. Although the capital required to integrate at this interface is directly constraining, Michigan celery producers indicated the critical factor preventing them from vertically integrating at this interface was the savings in seed cost (if there would even be any savings) would not outweigh the risks associated with trying to produce their own celery seed.

4.3.3 The production-marketing interface in the Michigan celery industry

A number of vertical coordination strategies are prevalent at the production-marketing interface within the Michigan celery industry. These strategies include spot market, strategic alliance, formal cooperation, and vertical integration. The use of specification contracting at the production-marketing interface is seldom used. Some celery producers choose to sell their celery through brokers on a spot market basis. Other producers enter an informal agreement where a shipper has the responsibility to move a predesignated portion of the producer's celery crop (occasionally this may consist of the entire crop). There is no contract, just an understanding that the shipper will do their best to market the celery, and the producer will do his/her best to keep the shipper informed on the quality and quantity of marketable celery (a type of strategic alliance). The Michigan Celery Promotion Cooperative is an example of formal cooperation at the production-marketing interface. One of the functions of the cooperative is the coordination of marketing, specifically the pricing of fresh celery shipments to members.

4.3.3.1 Vertical integration at the production-marketing interface by large western growers

Most of the large western vegetable producers are integrated at the production-marketing interface. That is they prefer to sell directly to the retail, food service, wholesale, and process buyers. These large growers often have huge investments in land, equipment and labor (high asset specificity). Customer specificity is high (their customers are becoming more sophisticated and they demand more) and these firms work hard to establish a brand identity in the marketplace all of which points to high levels of asset specificity. It was argued that nonseparability was high for these firms at the genetics and seed production interfaces and the same holds true at the production-marketing interface. Therefore, costliness of a coordination error is reduced by employing a vertical integration strategy at the production-marketing interface for these large western celery producers.

Programmability and implementability are not constraining for these large western grower/shippers since it is the dominant form of coordination for these western firms. The risk/return tradeoff associated with vertical integration is acceptable because most of these large shippers believe they can reduce their risk and increase the potential for profits by vertically integrating at the production-marketing interface.

4.3.3.2 *Returning to the Michigan celery producer and the framework at the production-marketing interface*

If vertical integration is the appropriate vertical coordination strategy for these large western grower/shippers at the production-marketing interface, why are Michigan celery producers not integrating at this interface? There are a number of reasons for not vertically integrating and the framework offers some insights. The average Michigan celery producer is much smaller than the size of the average western producer, which means the average Michigan celery producer is not able to capture the economies of size those western producers enjoy. Seasonality is a big problem for Michigan producers who are only in the market for four months versus the large western growers who are in the market year round.

Viewing seasonality as another form of temporal asset specificity which increases the costliness of a coordination error is reasonable. This form of temporal asset specificity also affects the risk/return tradeoff associated with vertical integration as a strategy compared with other less intensively controlled strategies. For the average Michigan celery producer the risks of vertically integrating at the production-marketing interface are substantial and expected profits are likely to be the same or lower compared with formal cooperation, their dominant strategy at this interface.

One might argue that asset specificity is higher for the western grower versus the Michigan producer. On average, western producers also feel the need to be responsive to the final consumer more than the average Michigan producer. As a result, the western producers seek vertical coordination strategies farther to the right on the continuum than Michigan producers. On could argue that as asset specificity and nonseparability, in particular, continue to rise, Michigan celery producers will need to seek alternative strategies if they are to survive in a marketplace dominated by large producers who are driven to meet final consumer needs.

4.3.4 The marketing-buying interface in the Michigan celery industry

A wide range of vertical coordination strategies are utilized by the Michigan celery industry at the marketing-buying interface including spot market, specification contracting, and strategic alliance. That is, some celery marketers choose to sell to retail, food service, and wholesale buyers via the spot market, trying to get as much for their celery as possible, while it is standard practice to sell to celery processors and fresh-cut manufacturers (e.g., companies that make soup, or prepared salad mixes) on a contract basis.

Retail and food service buyers increasingly push for season-long contracts. Strategic alliances take place between celery marketers and buyers where the Michigan celery marketer may be given the first opportunity to meet the needs of the buyer (i.e., to match a non-Michigan celery marketer's price). Strategic alliance components occur when the Michigan Celery Promotion Cooperative sets the price celery shippers may accept when negotiating with their buyers. Finally, vertical integration is not typically found at the marketing-buying interface, except in the situation where a celery producer operates a road side stand, which is highly unusual.

The least amount of difference between Michigan celery producers and the large western growers/ takes place at marketing-buying interface. However, there is a growing trend in the produce business where the seller and marketer are increasing entering into non-spot market relationships such as season long contracts. Given their smaller size and limited time in the market, Michigan celery growers and shippers may find it difficult to enter these types of vertical coordination strategies. For example, a western shipper who is in the market year round can set a long-term contract price with seasonal adjustments which may be lower during the Michigan marketing season. This contract price could be lower than the Michigan producer's price because the western grower can probably offset this low summer contract price with higher contract prices the rest of the year.

4.3.5 Concluding remarks regarding the four transaction interfaces in the Michigan celery industry

Although asset specificity and nonseparability are somewhat high for Michigan celery producers, the costliness of a coordination error is higher for Western celery producers because they face even higher asset specificity and nonseparability. This higher costliness of a coordination error drives the Western celery producers to seek vertical integration as their primary vertical coordination strategy at the genetics-celery seed production interface, the celery seed production-commercial celery production interface, and at the commercial celery production-marketing interface. Vertical integration is seldom used at any of these interfaces by Michigan celery producers.

The large western celery producers have reached economies in size regarding seed production, celery production, and marketing. The temporal asset specificity associated with the short Michigan celery season and their small size does not allow the average Michigan celery producer to capture the 8 percent brokerage cost they pay to the shippers (by integrating at the production-marketing interface).

The large western celery producers and Michigan celery producers currently deploy the same strategies at the marketing-buying interface. However, western producers are more likely to employ strategies at this interface which require more intensive control (contracts, strategic alliances, etc.) than Michigan celery producers because their larger size and longer marketing season.

In summary, the need to reduce the costliness of coordination errors has a considerable impact on the decision by western celery producers to increase their marketing season, increase their size and to increase their marketing expertise and aggressiveness relative to Michigan celery producers.

4.4 Vertical Coordination Strategy From the Perspective of a Large Consumer Foods Company

This subsection will illustrate the influence a single company (Frito Lay) can have on the vertical coordination strategies that are employed across an entire value chain. The analysis begins at the interface between Frito Lay and the ultimate customer and proceeds back through the Frito Lay value chain (see Figure 4.4). This approach is the opposite of the approach used to explain the various types of vertical coordination strategy that were present at the four transaction interfaces in the Michigan and Wisconsin seed potato and Michigan celery industries. Frito Lay is a consumer-driven food company, where everything they do is geared toward increasing market share and profits by satisfying the needs of their customers.

Given the importance that Frito Lay places on responsiveness to the final consumer, costliness of a coordination error for Frito Lay is presented separately from the discussion of the strategies at the various interfaces in the Frito Lay value chain. Programmability, implementability, and the risk/return tradeoff are discussed in situations

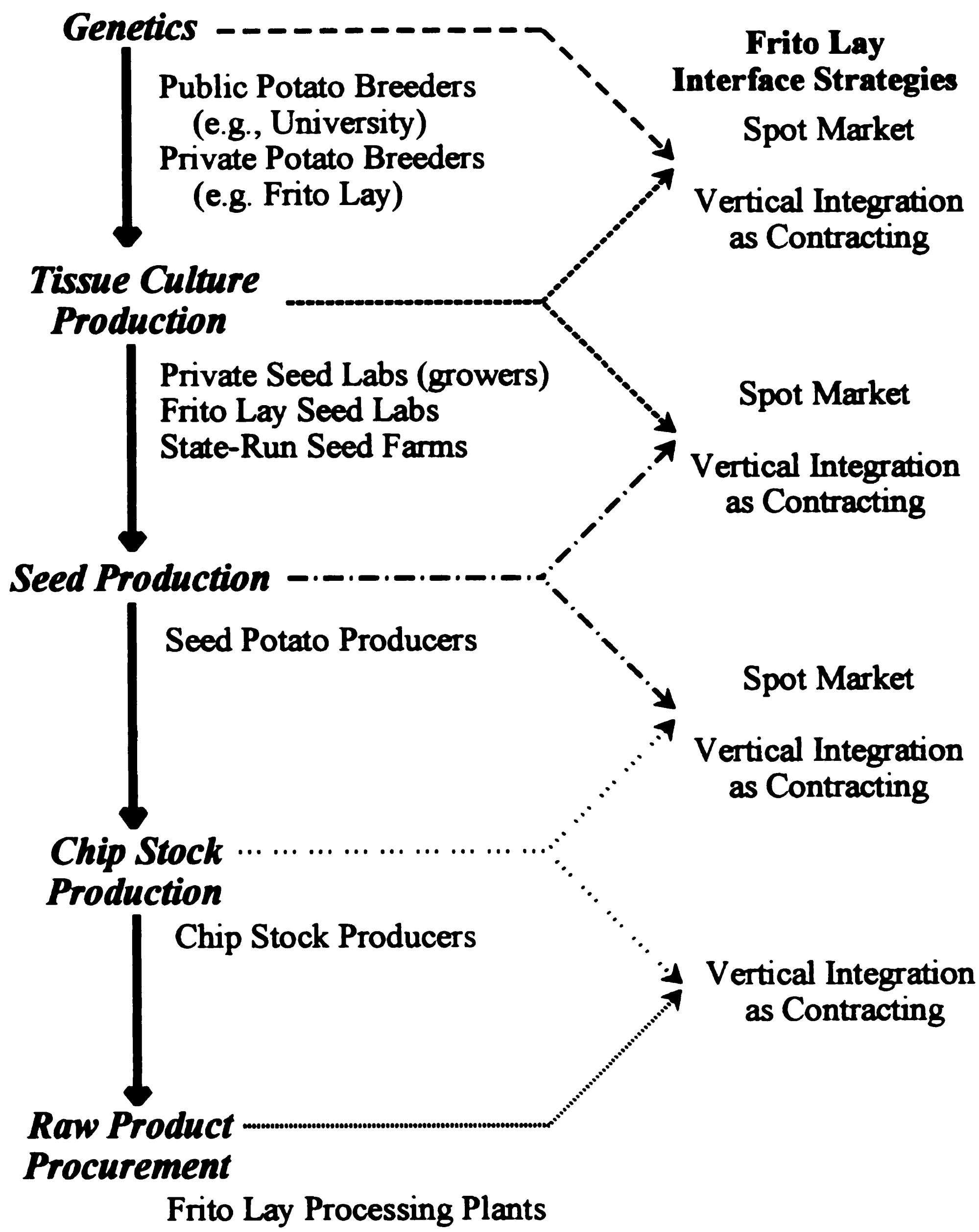


Figure 4.4 The Frito Lay Value Chain

where they help explain the dominant vertical coordination strategy chosen by Frito Lay at a particular interface.

4.4.1 Costliness of a coordination error in the Frito Lay value chain

Costliness of a coordination error is high in the Frito Lay value chain as defined by high levels of asset specificity and high levels of nonseparability. Given Frito Lay's direct contact with the final consumer (i.e., the potato chip eating public) and their immersion into the competitive snack food business, one could argue that nonseparability is high throughout the Frito Lay value chain. Frito Lay has the largest share of the snack food market and Frito believes in controlling as much of their value chain as possible to maintain and extend their competitive advantage. This translates all the way back through the value chain into the genetics. At first glance, Frito uses a combination of vertical coordination strategies to meet these consumer needs. The framework will be used to show how Frito Lay is in fact using vertical integration (similar to Tyson Foods as defined in Chapter 1) to control the transactions in their value chain.

One could also argue that asset specificity is high for Frito Lay and is expressed here in terms of site and physical asset specificity, product specificity, customer specificity, brand name specificity, human asset specificity, and temporal specificity. Site and physical asset specificity is present because potato processing plants and the technology required to create a perfect chip is a significant investment in very limited-use assets. Traditionally, potato chip plants were found close to the production areas. Any new plants are now located close to population centers to reduce distribution costs and to increase responsiveness to final consumers. Physical product specificity was already alluded to, in that, the perfect potato chip requires the combination of excellent raw product, adequate storage and handling of the raw product to the plant, and the latest in technology. Temporal specificity arises out of the need for Frito to source potatoes from many different growing areas to maintain a constant supply of fresh raw product. Chipping potatoes have a relatively short storage life.

Human asset specificity is involved at all levels of this value chain to produce the perfect chip. Knowledge of marketing, distribution, processing, grower relations, commercial production, seed potato production, and the knowledge of genetics are all utilized. This knowledge is needed to achieve the perfect chip is usually cultivated within Frito Lay. However, Frito Lay is willing to work with others in areas where they lack expertise (e.g., seed potato production).

Frito Lay, (owned by PepsiCo) is one of America's best recognized brands, and as a result they have invested heavily in name brand recognition. Frito Lay is very protective about what they put their name on. Brand specificity is high for Frito Lay. Related to maintaining high brand identity is customer specificity. Frito's customers (grocery stores, convenience stores, etc.) are becoming increasing sophisticated and increasingly demanding of the food system to give them the products and services they require.

In summary, costliness of a coordination error as defined by nonseparability and asset specificity is high in the Frito Lay value chain which would suggest the use of vertical coordination strategies which rely on a high intensity of control (e.g., vertical integration) versus invisible hand coordination (e.g., spot markets). In fact, Frito Lay uses contracts throughout their value chain. However, contracts are used in name only, as Frito has the true control in transactions with their contracting partners. In Chapter 1, these types of arrangements are a form of vertical integration and will be denoted as vertical integration by contracting.

4.4.2 The chip stock production-raw product procurement interface in the Frito Lay value chain

Chip stock is a potato industry term that denotes a commercial potato producer who is raising potato varieties suited for processing as potato chips. The dominant vertical coordination strategy used by Frito Lay at this interface is vertical integration as contracting[28]. If costliness of a coordination error is high for Frito Lay as a company, one would expect to see strategies from the continuum which are closer to, and including, vertical integration. If costliness of a coordination error was the only factor considered, this would likely be the case. However, as the framework asserts, decision makers also take into account programmability, implementability, and the risk/return tradeoff when considering choice of vertical coordination strategy.

Programmability at the chip stock-raw product procurement interface is relatively low. That is, Frito Lay is in the processing business, and not in the production business. However, it is also reasonable to assume that if Frito wanted to, they could develop or acquire the knowledge needed to grow chip stock. In other words, programmability is not overly constraining at this interface.

Implementability may be somewhat constraining at this interface. Frito Lay, although highly profitable may not have the capital it would take to grow the quantity of

[28]It is worth noting at this interface that over the last five years, Frito Lay has moved to contracting with fewer and larger chip stock growers.

raw product they would need to supply their plants. Compatibility, competence and institutional acceptability may not be constraining at this interface.

Perhaps the strongest argument for contracting over other vertical coordination strategies is the acceptability of the risk/return tradeoff. For example, the risk and uncertainty associated with growing crops is high, while the profits associated with production are likely to be lower than what Frito currently makes in processing, distribution, and marketing of their products. Therefore, the risk/return strategy associated with vertical integration at the chip stock production-raw product procurement interface would be unacceptable. Vertical integration as contracting most likely offers the best amount of control given, the programmability, implementability, and acceptability of the risk/return tradeoff.

4.4.3 The seed production-chip stock production interface in the Frito Lay value chain

The most dominant vertical coordination strategy employed by Frito Lay at the seed production-chip stock production interface is vertical integration as contracting. Although spot market transactions occur, they are subject to prior approval by Frito Lay. Traditionally Frito Lay has allowed their chip stock producers to source seed material on the open market or from seed producers who were providing Frito Lay varieties. One university developed potato variety called the Snowden has chipped as well as any Frito variety. The chip stock grower's incentive to grow Snowdens, as opposed to Frito varieties is that the Snowden will usually out yield Frito varieties. As long as these university developed varieties continue to perform, Frito is likely to allow their growers to source seed where they want.

With Frito Lay varieties, seed producers must be recognized as a Frito seed grower before they are given the genetic material to propagate or to sell to approved Frito chip stock growers. As with the chip stock production-raw product procurement interface, Frito Lay's decision to use vertical integration as contracts is based on their ability to control the transactions, even if they appear to be contracts and spot markets.

4.4.4 The tissue culture-seed production interface in the Frito Lay value chain

The dominant vertical coordination strategies utilized by Frito Lay at the tissue culture production-seed potato production interface are identical to those used at the seed potato production-chip stock production interface: spot market and vertical integration as contracting. Frito Lay has probably not gone into the seed production business (integrated backwards) for the same reasons they are not in the chip stock production business. Namely, the capital would be substantial, programmability could be a problem, and the risk/return tradeoff is not likely to be acceptable.

4.4.5 The genetics-tissue culture production interface in the Frito Lay value chain

The dominant vertical coordination strategies present at the genetics-tissue culture production interface include spot markets, contracting, and vertical financial integration. Frito Lay has chosen to get involved in the genetics of chipping potato production. This is not surprising, given the high nonseparability and high asset specificity associated with the Frito Lay value chain. Frito Lay has a plant breeding program and tissue culture facilities. Frito Lay has become increasingly willing to contract tissue culture production with a few private tissue culture labs.

As indicated earlier, Frito Lay seed producers are free to purchase their genetic material from non-Frito sources with prior approval. Frito itself will even obtain genetics from other sources such as universities and private tissue labs on occasion. Based on the presence of vertical integration at this interface, one would expect the costliness of a coordination error, programmability, implementability, and the risk/return tradeoff to be acceptable. The reader may wonder why Frito Lay allows the use of different vertical coordination strategies at this interface. Until recently, Frito Lay's breeding program was not as productive as the university breeding system and private tissue labs. However, the next section describes the likely future of control in the Frito Lay value chain.

4.4.6 Concluding remarks regarding the Frito Lay value chain

The real insight into Frito Lay's choice of vertical coordination strategies throughout the Frito Lay value chain may be best illustrated by a recent Frito Lay acquisition. Frito Lay recently acquired the property rights to the Bt gene (this gene is used to combat the Colorado potato beetle) used in chip stock production. Any new chip stock potato varieties which incorporate the Bt gene, are in effect, the property of Frito Lay. For now, it is business as usual in the Frito Lay value chain. If Frito Lay is successful in developing a chip stock variety that out performs the Snowden, seed potato and chip stock growers will only have access to the variety if they are part of the Frito system. In this type of system, where Frito controls the genetics as well as the marketing interface, Frito Lay does not have to take financial ownership of the assets in the value chain to control them.

4.5 Concluding Remarks Regarding the Industry-Based Case Studies

This chapter presented the highlights of four industry-based case studies: the Michigan seed potato industry, the Wisconsin seed potato industry, and the Michigan celery industry. A general description of the strategies employed at four interfaces in each of the three industries revealed a surprising number of competing vertical coordination strategies. A discussion of the primary strategy differences between Wisconsin and Michigan seed potato producers was followed by an illustration of how the framework was used to explain differences in strategy selection between the average Michigan celery producer and large western vegetable grower/shippers at various interfaces. The chapter concluded with a discussion of the strategies and their impact on seed potato producers in the value chain of a large consumer foods company (Frito Lay) were explained in terms of the proposed framework at four transaction interfaces. .

The conclusions drawn from the four industry-based case studies point to the framework's usefulness in explaining the existence of various coordination strategies and performance differences for firms in the Michigan and Wisconsin seed potato industries, and the Michigan celery industry. Additionally, industry-based case studies may also be insightful when individual case studies are aggregated to create the analysis of an entire industry, similar to the way economics aggregate individual supply curves to achieve an industry supply curve.

DETERMINANTS OF FIRM-LEVEL COORDINATION STRATEGY IN A CHANGING AGRI-FOOD SYSTEM

VOLUME II

By

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CHAPTER 5
ANALYSIS OF THE INTERVIEW RESPONSES: QUALITATIVE AND QUANTITATIVE METHODS

The four industry-based case studies presented in the last chapter applied the proposed framework at the industry level. The framework was used to explain the increasing use of contractual arrangements taking place in the chipping potato value chain, the primary differences and similarities between the Michigan and Wisconsin seed potato industries, and the key differences between Michigan and the large western celery producers.

Use of the proposed framework allows the researcher to gain insight into selected industry level events, but how does the framework perform when applied at the level of the individual decision maker? In this chapter the analysis is on individual producers and their decisions about vertical coordination strategy. Extensive interview responses from twenty-five producers were used in the development of qualitative and quantitative analyses see Appendix A for a copy of the questionnaire). These results are used to show strong support for the framework, and in particular, they highlight the importance of the costliness of a coordination error and the acceptability of the risk/return tradeoff in the decision making process.

An indirect method was used to test the proposed framework. A change in vertical coordination strategy was simulated by taking twenty-five producers with varying levels of satisfaction with their current coordination strategy and asking them about alternative strategies they have considered.

The rest of the chapter is divided into the following seven sections: (1) explanation of the key variables used in the analysis, (2) demographic characteristics of the producers, (3) cross tabulations and the Pearson chi-square test, (4) general findings based on qualitative research methods, (5) the relevance of the qualitative research findings to the proposed framework, (6) quantitative analysis of the interview responses based on discriminant analysis, and (7) presentation of parallel decision step framework.

5.1 Explanation of the Key Variables

Due to the qualitative nature of this research, most of the interview responses lent themselves to coding as categorical versus continuous variables. In this section the specific categories used in the coding of these variables, and the logic and criteria applied during the creation of the dependent and four key independent variables are discussed.

5.1.1 A producer's willingness to change vertical coordination strategy

The ideal direct test of the decision framework would have entailed finding a group of producers who had recently considered specific changes in vertical coordination strategy and then asking them to report on the decision process they had pursued. Substantial difficulty in identifying such producers precluded this research approach. The researcher did have access to producers in two industries that were experiencing performance problems and changing vertical structures. Therefore, a decision was made to use these producers in an interview setting in which they were asked to consider a change in vertical coordination strategy and then describe how they would arrive at a change decision. Each producer was asked to consider an alternative strategy that they had recently thought about.

Rather than working from an actual change in strategy, the interviews led to what could be observed as a producer's willingness to change to the alternative strategy being considered in the interview. Based on a summary of verbal cues at the end of each interview, the researcher assigned a "Willingness" or an "Unwillingness" of producers to change from their current vertical coordination strategy to the alternative strategy proposed. For example, responses such as "I will not switch unless the buyer forces me to," "We were willing to join the cooperative, but they wanted it to be all or nothing, so we are not planning to join the cooperative at this time," and "Based off the risks and returns associated with spot markets, I would be foolish to adopt this strategy" were all coded as an unwillingness to change. Responses like the following were coded as a willingness to change: "We are going to try a few contracts this season to see how they work," "I am currently looking for the right partners to form an alliance with," and "I think it is time the cooperative tried something different like hiring a salesperson and selling the celery ourselves." In no instance, did the verbal cues leave the researcher unsure of the respondent's willingness or unwillingness. There was a total of twelve (six celery, four seed potato, one onion, and one chipstock potato) producers who were unwilling to change and thirteen (five celery and eight seed potato) producers who were willing to change from their current vertical coordination strategy to an alternative strategy. This willingness to change variable became the dependent variable that the decision framework should explain if it has validity. It should be noted the split between unwilling and willing producers happened by chance. The research design did not call for an even number of unwilling and willing producers.

5.1.2 Are coordination errors costly?

In Chapter 2 it was proposed that costliness of a coordination error consisted of two primary factors: (1) the kind and strength of asset specificity present at the transaction interface being studied, and (2) the level of nonseparability affecting the decision maker's environment. The levels of asset specificity and nonseparability present were derived directly from questions asked during the interview process and each is discussed below.

5.1.2.1 The relationship between asset specificity and the costliness of a coordination error

Producers were first asked to consider the assets (e.g., buildings, equipment, first-hand experience, etc.) used in their operations. They were then asked how difficult finding alternative uses for these assets and skills would be. Their responses were coded as low, moderate or high asset specificity (a copy of the questionnaire used in this research can be found in the Appendix A).

Typical answers focused primarily on tangible assets such as buildings and equipment. However, identifying additional forms of asset specificity was possible for the investigator, such as, site (i.e., seed potatoes are grown in isolated areas to reduce the threat of disease), temporal (perishable products must be sold in a timely fashion), and customer (today's customers are becoming increasing complex). Producers were also asked how constraining the type and extent of asset specificity described above would be when considering the adoption of an alternative strategy.

The investigator believed a priori that asset specificity would be high in the Michigan industries covered in this study. Seed potato and celery producers tend to utilize highly specific equipment, such as, specialized planters and harvesters in their operations. However, the interview process revealed that perceived levels of asset specificity depended on the decision maker's outlook and the age of the assets being deployed. For example, most producers said they used to believe that finding alternative uses for assets employed in the production of celery would be difficult. However, these producers also said tough economic times had caused them to re-evaluate their businesses. It was common to hear comments such as "I could grow onions or other horticultural crops on this muck if I had to," and "My greenhouses could be used to raise bedding plants, not just celery plugs." Newer celery planting equipment has been designed to be easily adapted for planting other crops besides celery.

On average, the producers in the seed potato industry indicated slightly higher levels of asset specificity than producers in the celery industry (a mean score of 2.00 for celery, and 2.25 for seed potatoes, on a scale of 1-3). This difference in mean values between celery and seed potatoes was statistically significant at the .10 level using an F test based on a one way analysis of variance. Overall, seed potato producers believed the assets used in their business were more specific compared with the assets employed in celery production.

There were two producers interviewed who had direct ties to the seed potato and celery industries, but were classified as belonging to the chipping potato and onion industries respectively. Both producers rated asset specificity as high in their operations. These "high" levels of asset specificity resulted out of the decision makers' commitment to serving the needs of their respective industry. Producers who indicated the highest levels of asset specificity were commonly heard to say how every decision they made was tied into better serving the needs of their respective industries.

5.1.2.2 The relationship between nonseparability and the costliness of a coordination error

Increasingly, an entire value chain must perform at a high level if the individual firms of the chain are to perform well. If a link in the value chain breaks down, other firms in the chain are likely to suffer. Nonseparability was hypothesized to be influenced by two factors: (1) the sustainability of a firm's standalone competitive advantage and the need to establish linkages across transaction interfaces, and (2) the need for responsiveness to the ultimate customer in a given value chain. Decision makers were asked to describe what they or their firm did well compared with others in their industry. Through experience, this researcher has found the typical producer to be too modest when describing their standalone competitive advantage. Producers were encouraged to "brag" a little and to state why someone would want their products and services over another producer's products and services. Decision makers were also asked how easy it would be for others to copy or imitate the activities, skills, and competencies they described. A producer's standalone competitive advantage was classified as weak, moderate, or strong.

In Chapter 2, it was hypothesized a firm with a strong standalone competitive advantage was more likely to choose vertical coordination strategies based on a low intensity of control (e.g., spot markets and contracting) versus strategies based on a high intensity of control (e.g., formal cooperation and vertical integration). Nonseparability increases for firms when the sustainability of their standalone competitive advantage is based in part on finding appropriate linkages with other firms across the value chain. Producers were asked under what situations they would consider relationships with other firms as a way to improve their standalone competitive advantage. Examples of these linkages were solicited to better understand the nature of any linkages that existed.

One seed potato producer indicated they had spent the winter attending chip stock grower meetings (not seed potato grower meetings) sponsored by Frito Lay. His reason for attending these meetings was to learn more about the Frito Lay value chain and to better understand his buyers' needs. This response was coded as yes, the respondent did see the importance of linkages. If the producer's responses indicated they did not see the importance of linkages with others in the value chain, the response was coded as a no.

The primary focus of this research was to study changes in "vertical" rather than "horizontal" coordination strategy. Producers who only indicated linkages with other producers within the interface being studied (i.e., a celery grower who belongs to a cooperative) were coded as not seeing the importance of establishing linkages. However, if the respondent indicated they belonged to an input supply cooperative for gaining economies of scale in the procurement of inputs, this was coded as an indication of the respondent's ability to see the need for linkages with others. Many producers indicated the growing importance of establishing new linkages across their respective value chains. However, horizontal linkages might be more easily seen by the producers than vertical linkages across a transaction interface.

The final component of nonseparability is the need for responsiveness to final consumers. As the need for being responsive to final consumers increases, so does the level of nonseparability. Producers were asked what adjustments they have made in their businesses over the years. They were also asked how changing consumer tastes and preferences were affecting their operations. The need for responsiveness was coded as low, moderate, or high.

A distinction was made between seeing the need for responsiveness and the ability to be responsive. A number of the celery producers indicated a need to be more responsive to the final consumer (e.g., providing celery sticks that do not dry out), and their frustration regarding the inability of the celery industry to address these changing needs better. For example, the celery industry would love to find its industry equivalent to the whole-peeled baby carrots like the carrot industry has. Producers who indicated need for increased responsiveness, or awareness of their value chain's current inability to be responsive, were coded as expressing a high need for responsiveness.

Table 5.1 shows the factor levels and values used to assign a score to the overall level of nonseparability present at the respondent's transaction interface based on standalone competitive advantage, the importance of linkages, and the need for responsiveness to ultimate customers. The sum of the three factor values became an individual respondent's nonseparability score. Scores of five or less were coded as low nonseparability, scores of six were deemed moderate, while scores above seven were considered to exhibit high nonseparability. This scaling was based on the actual distribution of scores across the twenty-five cases.

The individual factor levels were assigned as follows. The stronger a firm's standalone competitive advantage, the lower the level of nonseparability. Therefore, strong standalone competitive advantage and was given the lowest score of one point, while weak standalone competitive advantage received a value of three points. A producer who did not see the importance of linkages or the need for ultimate customer responsiveness was given a score of one for each of these nonseparability components. Moderate and high expressed need for final consumer responsiveness received two and three respectively. Table 5.1 provides an example of the producer coded as case number five who indicated low stand-alone competitive advantage, saw the importance of linking, and felt a moderate need to be responsive to the ultimate customer. This combination resulted in a nonseparability score of seven which suggests high nonseparability.

Table 5.1 Coding Scheme for Determining the Level of Nonseparability

Factor	Factor Level	Value	An Example: Case no. 5
Standalone competitive advantage	Weak Moderate Strong	3 pts 2 pts 1 pt	Weak = 3
The need for linkages	Doesn't see the need Sees the need	1 pt 2 pts	Sees the need = 2
The need for ultimate customer responsiveness	Low Moderate High	1 pt 2 pts 3 pts	Moderate= 2
			Total= 7 High Nonseparability

5.1.2.3 Defining movement toward or away from the theoretically optimal strategy

In Chapter 2 it was stated that based on theoretical and empirical work involving transaction cost theory, agency theory, and resource-based theory, low levels of asset specificity and nonseparability are associated with vertical coordination strategies which rely on a lower intensity of control such as spot market and specification contracting, while high levels of asset specificity and nonseparability are associated with vertical coordination strategies which rely on a higher intensity of control such as formal cooperation and vertical integration. A simple trichotomous measurement of asset specificity and nonseparability was used in Table 2.2 to illustrate how the various possible combinations of asset specificity and nonseparability may map into theoretically optimal strategies. Based on responses to interview questions, eleven producers revealed that their theoretically optimal strategy was specification contract, three revealed strategic alliance, ten indicated formal cooperation, and one producer revealed vertical integration as their theoretically optimal strategy. Defining movement toward or away from the theoretically optimal strategy will now be discussed.

When considering the willingness to change from their current strategy to an alternative, a producer who exhibited a willingness to change implied an alternative strategy existed which would reduce the costliness of a coordination error. While a producer who exhibited an unwillingness to change implied an alternative did not reduce the costliness of a coordination error.

This notion of an alternative reducing the costliness of a coordination error can be represented by movement from the current to the alternative strategy that is toward or away from the theoretically optimal strategy. In Chapter 2 the levels of asset specificity and nonseparability were said to define the costliness of an error in coordination. This costliness of a coordination error was then linked to the intensity of control needed, which was linked in turn to choice of vertical coordination strategy. The level of control and its corresponding strategy that best matched the costliness of a coordination error was defined as the theoretically optimal strategy. Based on interview responses, the theoretically optimal strategy was identified for each of the twenty-five producers.

An alternative strategy reduces the costliness of a coordination error when the direction of shift from the current strategy to the alternative strategy is moving toward the theoretically optimal strategy (see Figure 5.1). If the producer's current strategy is

Figure 5.1 A Movement Toward the Theoretically Optimal Strategy

different from the theoretically optimal strategy, the costliness of a coordination error can be reduced by choosing an alternative strategy that moves the producer's strategy in the direction of the theoretically optimal strategy. Figure 5.1 illustrates a movement from a seed potato producer's (case number two) current strategy of spot market to the alternative he was considering (strategic alliance), that is toward his theoretically identified strategy of formal cooperation.

If the direction of shift from the current to the alternative strategy is away from the theoretically optimal strategy (see Figure 5.2), then the costliness of a coordination error is increasing (the alternative does not reduce the costliness of a coordination error). If the current strategy is the same as the theoretically optimal strategy, any alternative strategy will by definition cause a shift that is away from the theoretically optimal strategy, resulting in no reduction in costliness of a coordination error.

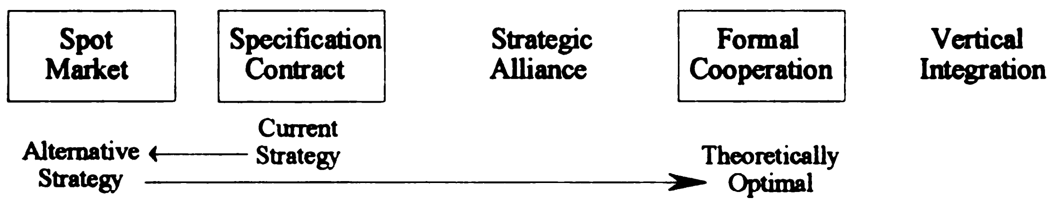


Figure 5.2 A Movement Away from the Theoretically Optimal Strategy

Figure 5.2 illustrates a movement from a seed potato producer's (case number three) current strategy of specification contract to the alternative he was considering (spot market), that is away from his theoretically identified strategy of formal cooperation.

5.1.2.4 Assigning values to whether or not an alternative strategy will reduce the costliness of a coordination error

Table 5.2 illustrates the coding scheme used to assign a value of yes or no to whether or not an alternative strategy will reduce the costliness of a coordination error. The level of asset specificity and nonseparability, as stated earlier are coded as low, moderate, or high respectively. An example of an alternative strategy which reduces the costliness of a coordination error and an example of an alternative strategy which does not reduce the costliness of a coordination error will be presented.

Table 5.2 Coding Scheme for Assigning Values to Whether or Not an Alternative Strategy Reduces the Costliness of a Coordination Error

Factor	Factor Levels	Case Number 2	Case Number 3
Level of asset specificity	Low Moderate High	High	High
Level of nonseparability	Low Moderate High	Moderate	Moderate
Current strategy	Spot Market Contracts Strategic Alliance Formal Cooperation Vertical Integration	Spot Market	Contract
Alternative strategy		Strategic Alliance	Spot Market
Theoretically Optimal Strategy (see Table 2.2)		Formal Cooperation	Formal Cooperation
(a) Direction of movement from the current strategy to the alternative in relationship to the theoretically optimal strategy [Toward of Away]		Toward	Away
Does an alternative strategy reduce the costliness of a coordination error? [No if (a) = Away, Yes if (a) = Toward]		Yes	No

In case number two, the producer's current strategy was spot market, while his alternative strategy was strategic alliance. Case number two exhibited high asset specificity and moderate nonseparability. The theoretically optimal strategy resulting from these levels of asset specificity and nonseparability was formal cooperation. The direction of movement from the current to the alternative strategy was toward the theoretically optimal strategy for case number two. Therefore, the alternative strategy did reduce the costliness of a coordination error.

In case number three, the producer also exhibited high asset specificity and moderate nonseparability. The theoretically optimal strategy resulting from these levels of asset specificity and nonseparability was formal cooperation. The producer's current strategy was contracting, while his alternative strategy was a spot market. The direction of movement from the current to the alternative strategy was away from the theoretically optimal strategy for case number three. Therefore, the alternative strategy did not reduce the costliness of a coordination error.

In summary, whether or not an alternative strategy reduces the costliness of a coordination error is a constructed measure in the decision process to alter a vertical coordination strategy. Given the variable's importance to the framework and its use in the rest of this chapter, a considerable amount of time was spent presenting the logic behind its coding. The logic behind the coding of the programmability, implementability, and acceptability of the risk/return tradeoff variables are presented next.

5.1.3 Programmability of the alternative strategy being considered

An alternative was considered programmable if the producer could identify effective management routines which would be used to aid in the adoption of the alternative strategy being considered. Programmability was to be coded as low, moderate, or high. However, all producers indicated the alternative strategies they were considering were programmable.

Reasons why programmability did not play a more important role include: (1) every respondent easily identified effective management routines which would aid the decision maker in the adoption of the alternative strategy (high programmability) resulting in no differences between producers who were unwilling or willing to change from their current strategy, and (2) an honest evaluation of the interview design suggests that the concept of programmability needs to be defined better. Reflecting on the interview process, it is not at all surprising that allowing the producers to select the alternative strategy would result in high programmability. The broader implications of programmability findings, including the design of future research will be discussed later in this, and the final chapter.

5.1.4 Implementability of the alternative strategy

In Chapter 2 it was hypothesized that implementability was composed of four main factors: capital, compatibility, competence, and institutional acceptability. These four categories of factors provide the underpinnings for the seven variables which were used to code the level of implementability in this research (see Table 5.3). There was no theoretical basis for weighting these seven variables used in the creation of the implementability variable as anything other than equal. Given the different scales between some of the seven variables, it was decided to standardize[27] the responses to these variables. These standardized responses were then added and coded into low or high depending upon their values after summation. Scores greater than zero were coded as low implementability, while scores less than or equal to zero were coded as high implementability. The data seemed to suggest a natural break at this point between low

[27]SPSS has the ability to standardize the responses of a variable. The responses from each of the seven variables were standardized according to a normal distribution.

Table 5.3 Coding Scheme for Implementability of the Alternative Strategy Being Considered

Factor	Factor Level	Standardized Values	An Example Case no. 24
How constraining is the amount of capital needed to adopt the alternative?	Low Moderate High	-.98 .31 1.59	Low = -.98
How constraining is access to capital regarding the adoption of an alternative?	Low Moderate	-.29 3.32	Moderate = 3.32
How constraining is the need for compatibility regarding the adoption of an alternative?	Low Moderate High	-1.42 -.11 1.21	Moderate = -.11
How constraining is the amount of labor needed to adopt an alternative?	Low Moderate High	-.67 .73 2.13	High = 2.13
How constraining is the revealed external coordination competence skill relative to the alternative?	Low Moderate	-1.20 -.80	Low = -1.20
What is the level of mismatch between revealed coordination characteristics and the alternative?	Low High	-.87 1.11	Low = -.87
How constraining is institutional acceptability regarding the adoption of an alternative?	Low Moderate High	-.52 1.33 3.18	Moderate = 1.33
Level of implementability	**Low** **High**	**score >0** **score ≤ 0**	**Low = 3.62**

and high implementability. An actual case example will be presented in detail shortly to clarify the coding process.

The majority of the seven variables used to classify the level of implementability were recoded low, moderate, and high from the original five point Likert scale due to the small cell counts. Original values of one or two were recoded as ones, while threes were recoded as twos, and values of four and five became threes. The variable for access to capital and the four main factors of implementability, capital, compatibility, competence, and institutional acceptability, are now presented along with the directly observed variables representing these categories.

5.1.4.1 *The coding of capital in implementability*

To assess the role of capital as it relates to the implementability of an alternative strategy, producers were asked two questions: (1) how constraining is the amount of capital needed to adopt the alternative strategy?, and (2) how constraining is access to capital regarding the adoption of an alternative strategy (see rows one and two in Table 5.3)? Original responses were coded on a five point Likert scale from not constraining to extremely constraining. Due to small cell counts from the relatively limited number of cases and a five point scale, these variables were collapsed into three categories in the manner described in the last section.

5.1.4.2 *The coding of compatibility in implementability*

Respondents were asked how constraining was the need for compatibility regarding the adoption of an alternative vertical coordination strategy? Original responses were coded on a five point Likert scale from not constraining to extremely constraining (see Appendix A for a copy of the interview questions). Due to small cell counts from the relatively limited number of cases and a five point scale, these variables were collapsed into three categories in the manner described in the last section.

5.1.4.3 The coding of competence in implementability

There were three variables related to the coordination competence of a decision maker: the availability of skilled labor, the revealed external coordination competence skills, and the revealed coordination characteristics of the producers.

Producers were asked how constraining the availability of skilled labor needed to carry out an alternative was. This question was designed to focus on the issues of how the need for skilled labor affects coordination competence the within a firm when selecting an alternative strategy. Original responses were coded on a five point Likert scale from not constraining to extremely constraining (see Appendix A for a copy of the interview questions). Due to small cell counts from the relatively limited number of cases and a five point scale, these variables were collapsed into three categories in the manner described in the last section.

To assess the producer's coordination competence, producers were asked to complete a two-page questionnaire (see Appendix B). The first question was designed to get the respondent to reveal something about their preference for coordination competence skills. These questions have been reproduced here for the reader's convenience. How producers characterized their business philosophy (external coordination competence skills) was found rational and logical. For example, consider how the producer identified as case number 24 in Table 5.3 answered this question:

> Consider the following sets of business philosophies described below. Please weight your preference for each set of two philosophies. A score of 0 implies the statement does not describe your philosophy at all, while a score of 5 implies the statement describes your philosophy very well. Assign a total of 5 points (no fractions) between each of the sets.
>
> 1. Business philosophy set one:
>
> __1__ I commonly seek a lot of information about various market prices, drive a hard bargain, and enjoy the challenge of on-the-spot dickering.
>
> __4__ I like to deal with people on the basis of long-term agreements which may be built on contracts or require the formation of a new business entity. At the core of these relationships are trust, and mutually shared interests. I enjoy balancing the needs of my operation against the demands of these various business arrangements.
>
> Total = 5
>
> 2. Business philosophy set two:
>
> __3__ I like to deal with people on the basis of long-term agreements which may be built on contracts or require the formation of a new business entity. At the core of these relationships are trust, and mutually shared interests. I enjoy balancing the needs of my operation against the demands of these various business arrangements.
>
> __2__ I prefer to have control over the inputs, production, distribution, and marketing of multiple segments of the seed potato production-marketing chain. I prefer to manage and oversee multiple business arrangements.
>
> Total = 5
>
> 3. Business philosophy set three:
>
> __2__ I commonly seek a lot of information about various market prices, drive a hard bargain, and enjoy the challenge of on-the-spot dickering.
>
> __3__ I prefer to have control over the inputs, production, distribution, and marketing of multiple segments of the seed potato production-marketing chain. I prefer to manage and oversee multiple business arrangements.
>
> Total = 5

The three sets of business philosophies listed above were based on three statements to describe a respondent's preference for horse-trading, negotiating/partnering/diplomacy, or controlling (as defined in Chapter 2). Set one compared horse-trading with negotiating/partnering/diplomacy, set two compared negotiating/partnering/diplomacy to controlling, while set three compared controlling with horse-trading.

All twenty-five producers answered these three sets of questions in a consistent manner. In the example above, the respondent revealed a preference for negotiating/partnering/diplomacy (score of 4) to horse-trading (score of 1) in business set one. In set two, they revealed a preference for negotiating/partnering/diplomacy (score of 3) over controlling (score of 2), while in business set three, controlling (score of 3) was preferred to horse-trading (score of 2). This respondent's logic was consistent overall because the final ordering of revealed preference, was in order: (1) negotiating/partnering/diplomacy, (2) controlling, and (3) horse-trading.

The reader may recall that in Chapter 2 the relationship between vertical coordination strategy and a decision maker's coordination preference was theorized (see Table 2.3). This revealed preference from the questionnaire regarding the external coordination competence skill was assessed against the skills needed (based on Table 2.3) to master the alternative strategy. Differences between the revealed external coordination competence skills and the theorized set of skills needed for the alternative were coded as low or moderate. If the producer's revealed external coordination competence skill was different from the alternative strategy being considered, it was coded as moderate. If the producer's revealed external coordination competence skill was the same as the alternative strategy being considered, it was coded as low.

Consider the producer identified as case number 24 in Table 5.3. This producer indicated his revealed external coordination competence skill was negotiating/partnering/diplomacy which corresponds to contract, strategic alliance, or formal cooperation as the appropriate strategy. The alternative strategy being considered by the producer in case number 24 was formal cooperation. Therefore, the revealed external coordination competence skill was the same as the alternative strategy being considered, and was coded as low.

Question four (see Appendix B) was designed to assess how constraining the level of mismatch was between the producer's revealed preference for coordination characteristics and the alternative strategy being considered. Producers were also asked to state their agreement or disagreement with a series of statements designed to assess the producer's preference for invisible hand or managed coordination characteristics. These responses were coded on a five point Likert scale from strongly agree to strongly disagree.

The responses to these statements were then tallied and ranked using a weighted average. A response of strongly agree was given a score of one, while a response of strongly disagree was given a score of five. From this distribution of scores across all twenty-five producers, an index designed to be normally distributed was created for this variable. Index values ranged from 2.33 to 4.67.

Values between 2.33 and 2.50 were coded as the producers expressing a preference for invisible hand characteristics of coordination, which corresponds to spot market. In Chapter 1 the relationship between coordination characteristics and vertical coordination strategy were presented (see Figure 1.3). Values between 2.51 and 2.65 were coded as the producers expressing a preference for a combination of invisible hand and managed characteristics of coordination, which corresponds to contracts, strategic alliance, and formal cooperation spot market. Values between 2.66 and 4.67 were coded as the producers expressing a preference for managed characteristics of coordination, which corresponds to vertical integration.

The alternative strategy being considered by the producer was then compared with this revealed measure of a producer's preference for various coordination strategies based on statements of coordination characteristics. If the alternative strategy was the same as the strategy indicated by the indexed preference for coordination characteristics, mismatch was coded as low. If the alternative strategy was the different from the strategy indicated by the indexed preference for coordination characteristics, mismatch was coded as high.

5.1.4.4 The coding of institutional acceptability in implementability

Respondents were asked how constraining was the institutional acceptability regarding the adoption of an alternative vertical coordination strategy? Original responses were coded on a five point Likert scale from not constraining to extremely constraining (see Appendix A for a copy of the interview questions). Due to small cell counts from the relatively limited number of cases and a five point scale, these variables were collapsed into three categories in the manner described in the last section.

Institutional acceptability and its effects on the adoption of an alternative strategy were for the most part, found not constraining. When the institutional acceptability question was raised, the interview discussion almost always turned to the effects of the FQPA (Food Quality Protection Act) on American agriculture. In this sense, institutional acceptability was found to have a larger impact on whether or not a decision maker would stay in business versus any noticeable effect on the choice of a particular strategy.

Institutional acceptability was another variable which will require considerable refinement if it is to be used in further research involving decision making process of changing a vertical coordination strategy.

5.1.4.5 An example of assigning values to the implementability variable

The producer in Table 5.3 identified as case number 24 indicated that the amount of capital required to carry out the alternative strategy being considered was not very constraining, and as such was given a score of -.98 (these scores have been standardized). The producer also indicated that access to capital needed for adoption of the alternative strategy would be constraining (a score of 3.32). Compatibility was deemed to be constraining as well (-.11), while the amount of skilled labor required was found highly constraining (2.13). The producer's revealed external coordination competence skills were found not constraining (-1.20), and the level of mismatch between the producer's revealed coordination characteristics and the alternative strategy was high (-.87). Finally, institutional acceptability was only moderately constraining (1.33). The total implementability score was 5.60, and as a result, the implementability of the alternative being considered was coded as low.

In summary, it was the combination of access to capital, compatibility with available partners, the scarcity of skilled labor, the mismatch between the case number twenty-four's preference for a combination of invisible hand and managed coordination characteristics and the alternative strategy he was considering which led to low implementability.

5.1.5 Acceptability of the risk/return tradeoff

There were five directly observed variables which were related to the acceptability of the risk/return tradeoff of the alternative strategy being considered. These include: (1) the uncertainty surrounding the alternative strategy, (2) the riskiness of the proposed alternative strategy, (3) the profit potential of the alternative strategy, (4) the expected profit of the alternative relative to the current strategy, and (5) whether or not the decision maker would adopt the alternative strategy based on its risk/return tradeoff (see Table 5.4).

Table 5.4 Questions Related to the Acceptability of the Risk/Return Tradeoff for the Alternative Strategy Being Considered

Question/Variable	Factor Level
How constraining is the uncertainty surrounding the alternative strategy?	Not Slightly Moderate Very Extremely
How risky is the adoption of the alternative strategy?	Low Moderate High
How constraining is the profit potential of the alternative strategy?	Not Slightly Moderate Very Extremely
How do you expect the returns of the alternative to compare to the current strategy?	Lower Same Higher
Would the decision maker adopt the alternative based on the risk/return tradeoff?	No Uncertain Yes

Producers were asked the above five questions during the interview process and their responses were coded by the investigator according to the values shown in Table 5.4. Two separate, but closely related questions were asked of producers regarding uncertainty and risk. In Chapter 2, a distinction was made between risk and uncertainty responses, but for most decision makers this distinction is seldom a conscious one. Not surprisingly, these risk and uncertainty are highly positively correlated at .743, and they are statistically significant at the .001 level using the Pearson correlation test. The uncertainty question was coded on a five point Likert scale from not constraining to extremely constraining. Producers were asked to say how risky the adoption of an alternative strategy would be relative to their current strategy. Producers were asked to choose from a three point scale in this instance: low, moderate, or high.

The same methodology was used to identify how constraining the expected profit of the alternative strategy would be and to understand if the respondent believed the expected returns of the alternative strategy would be lower, higher, or the same as the returns from the current strategy. As expected, producers considered these questions to be two sides of the same concept and these two questions were highly negatively correlated at -.809 (significant at the .0001 level using the Pearson test for correlation). The more constraining levels of expected profits are associated with expected returns which are lower than the current strategy.

The final component used to provide insight into the overall acceptability of the risk/return tradeoff of an alternative being considered was whether the decision maker would adopt the alternative based on the risk/return tradeoff. Producers were asked to state if they would adopt, would not adopt, or if they were undecided about adopting an alternative strategy based on the acceptability of the risk/return tradeoff. This question was used directly to represent the structural variable for the acceptability of the risk/return decision node.

To adopt the alternative strategy based on the risk/return question will be used primarily in the analysis of the interview data. Whenever appropriate the other four variables will be used in an appropriate manner (e.g., uncertainty and profit questions will be substituted for the adopt based off the risk/return question) to assess their contribution to the decision process for altering a vertical coordination strategy.

The variable which asked the question if producers would adopt an alternative strategy based on the combination of expected risk and return was deemed a direct observation of the acceptability of the risk/return decision node. However, is was argued that the questions asked regarding uncertainty, risk, how constraining expected profits would be, and if the returns of the alternative would be lower, same, or higher than the current strategy could also be used as proxies for the acceptability of the risk/return tradeoff.

The key variables used in the qualitative and quantitative analysis were defined in this section. These detailed definitions were necessary given their constructed nature. The variable which describes whether or not an alternative reduces the costliness of a coordination error was constructed from observations of a producer's asset specificity, nonseparability, current strategy, and alternative strategy. Programmability and the acceptability of the risk/return tradeoff were observed directly. The implementability of an alternative strategy was constructed from seven separate variables.

5.2 Demographic Characteristics of the Producers

The investigator was pleased with response for his request to interview producers from the Michigan celery and seed potato industries. Participation in the interview process required the respondent set aside an average of one and a half hours out of their busy schedules. Out of twenty-eight people who were contacted and asked to participate, only three were unable to participate. This resulted in an effective participation rate of 89.3 percent. The investigator's past contacts with the Michigan celery and seed potato industries were invaluable in obtaining this high response rate for the interviews.

The primary emphasis in this section will be on general demographic characteristics which help to distinguish producers who were willing to change from those who were not willing to change from their current vertical coordination strategy. A brief section has been included to provide basic background information on the producers according to the industry to which they belong.

5.2.1 Producer characteristics by industry

Table 5.5 is a list of producer characteristics by industry. There are three industry categories: celery, seed potatoes, and other. The other category is comprised of one chipping potato grower who grows a fair amount of his own seed, and an onion grower who quit raising celery in 1996. Primary comparison in this section will be made between celery and seed potato producers, of which there were 11 and 12 producers respectively.

The column labeled "other" is provided for completeness and comparison to the celery and seed potato industries. The reader is encouraged to look at Table 5.5 if they are interested in how the producers of the other column compare to the celery and seed potato industries.

Table 5.5 Producer Characteristics by Industry

Characteristic	Industry		
	Celery	**Seed Potatoes**	**Other[28]**
Number of producers	11	12	2
Total acres in celery or potatoes farmed in 1997	950	1915	na
Total acres in celery or potatoes farmed in 1995	1022	2058	na
Average per farm acreage in celery or potatoes in 1997	86	130	na
Average per farm acreage in celery or potatoes in 1995	87	144	60
Range of per farm acreage in celery or potatoes in 1997	25-200	0-350	na
Percent of total Michigan acreage represented by crop	41%	77%	na

5.2.1.1 Michigan celery producers

The total number of acres of celery represented in the study was 950 acres, with an average of 86 acres of celery per farm. The total number and average acres devoted to celery has changed little since 1995. The 950 acres of celery reported by producers represents approximately 41 percent of the Michigan celery acreage in 1997. The smallest celery grower in the sample raised 25 acres, while the largest grower had 200 acres. Nine out of the eleven celery producers belonged to the Michigan Celery Promotion

[28]Other industries consist of two producers: one, a former celery grower now just in the onion business, the other is a chipping potato grower who also grows some of his own seed.

Cooperative. Members of this cooperative account for approximately 75 percent of the state's celery production annually.

The average number of acres owned by celery producers was 115 acres, while the average number of rented acres was 113 acres. Although celery was the most important crop for the many celery producers, the vast majority of Michigan celery producers rotated crops such as carrots, onions, and radishes with their celery.

5.2.1.2 Michigan seed potato producers

The total number of acres of seed potatoes represented in the study was 1915 acres, with an average of 130 acres of seed potatoes per farm. The total and average number of acres devoted to seed potatoes has changed little since 1995. The 1915 acres of seed potatoes reported by producers represented approximately 77 percent of the Michigan seed potato acreage in 1997. The smallest seed potato grower in the sample quit raising seed potatoes in 1997, while the largest grower had 350 acres.

The average number of acres owned by seed potato producers was 536 acres, while the average number of rented acres was 282 acres. Although seed potatoes were the most important crop for most of the seed potato producers, the vast majority of Michigan seed potato producers rotated crops such as alfalfa, field corn, and wheat with their seed potatoes.

5.2.2 Producer characteristics by willingness to change their current strategy

The focus of this section is on describing the general characteristics of producers who were unwilling to change from their current vertical coordination strategy and those producers who expressed a willingness to change from their current vertical coordination strategy to an alternative which was discussed during the interview process. The similarities and differences between these two groups are discussed below.

5.2.2.1 Producers who were unwilling to change from their current strategy

In Table 5.6, the average number of years the typical producer who was unwilling to change from their current strategy are associated with businesses that have been in farming continuously for 52 years compared to producers who were willing to change at 42 years. This difference was found significant at the .05 level using a chi-square statistic.

The range of years a firm has been in the celery or seed potato business was 20 years up to 115 years for one farm, while unwilling producers ranged from 8 years to 70 years in the celery or seed potato business. Family corporations were the dominant form of business organization among unwilling producers (58.4%), followed by family partnerships (25.0%), individual owners (8.3%), and limited partnerships (8.3%). Just as with those producers who were unwilling to change, family corporations were the dominant form of business organization among producers who were willing to change (46.1%), followed by individual owners (38.5), and family partnerships (15.4%).

Just over 40 percent of the producers who were unwilling to change were between 36 and 45 years of age (41.7 percent), while 33.3 percent were slightly older (between 46 and 55 years old). Only 16.7 percent of the producers who were unwilling to change were between 56 and 65 years of age, and one of the producers who were unwilling to change was older than 65 years of age.

Table 5.6 Producer Characteristics by Willingness to Change

Characteristic	Unwilling to Change	Willing to Change
Number of producers	12	13
Average total acres of owned farmable land in 1997	579	420
Average total acres of rented farmable land in 1997	813	83
Average no. of years the farm has been in the business	52	42
Range of years the farm has been in the business	20-115	8-70
Satisfaction with current strategy		
Not satisfied		7.7%
Moderately satisfied	25.0%	76.9%
Strongly satisfied	75.0%	15.4%
Type of business organization		
Individual owner	8.3%	38.5%
Family partnership	25.0%	15.4%
Limited partnership	8.3%	
Family corporation	58.4%	46.1%
Age of primary decision maker		
Between 36 and 45 years old	41.7%	53.8%
Between 46 and 55 years old	33.3%	30.8%
Between 56 and 65 years old	16.7%	
Older than 65 years old	8.3%	15.4%
Age of potential successor		
Less than 25 years old	25.0%	46.2%
Between 25 and 35 years old	41.7%	15.4%
Between 36 and 45 years old	8.3%	7.7%
No successor at the present time	25.0%	30.7%
Average number of people on the management team	3.75	2.15
Range in number of people on the management team	1-10	1-4

Table 5.6 (cont'd)

Characteristic	Unwillingness to Change	Willingness to Change
Highest level of formal education		
Completed highschool	25.0%	53.8%
Some undergraduate	16.7%	7.7%
Completed undergraduate	50.0%	30.8%
Some graduate		7.7%
Completed graduate	8.3%	
Expect to remain in business in 1998?		
No	16.7%	7.7%
Unknown		
Yes	83.3%	92.3%
Expect to remain in business in 2003?		
No	16.7%	7.7%
Unknown		15.4%
Yes	83.3%	76.9%
Expect to remain in business in 2008?		
No	16.7%	7.7%
Unknown	25.0%	46.2%
Yes	58.3%	46.2%
Expect to remain in business in 2018?		
No	16.7%	15.4%
Unknown	50.0%	53.8%
Yes	33.3%	30.8%

Just over half the producers who were willing to change were between 36 and 45 years of age, while 30.8 percent were slightly older (between 46 and 55 years old). None of the producers who were willing to change were between 55 and 65 years of age, while 15.4 percent of the producers who were willing to change were older than 65 years of age.

A chi square test of the ages of potential successors and a producer's willingness to change was not significant at the .05 level. However, it appears that producers with younger successors were more willing to change than older producers. The breakdown between is as follows: 25.0 percent were less than 25 years, 41.7 percent were between

25 and 35 years old, while 8.3 percent were between the ages of 36 and 45 years of age. Twenty-five percent of the producers who were unwilling to change indicated there were no successors currently in place because they were too young, not interested, or the respondent had no offspring. Producers who were willing to change indicated they had a higher percentage of young successors versus the producers who were unwilling to change: 46.2 percent were less than 25 years, 15.4 percent were between 25 and 35 years old, 7.7 percent were between 36 and 45 years of age, and 30.7 percent of the producers who were willing to change indicated there was no successor currently in place in the operation because they were too young, not interested, or the respondent had no offspring.

Producers who had larger management teams were less willing to change from their current vertical coordination strategy to an alternative. A chi-square test was significant at the .05 level. The average number of people on a management team where the producer was unwilling to change from their current strategy was 3.75, with a range from one to ten people, including spouses where appropriate.

Twenty-five percent of the producers who were unwilling to change indicated the highest level of formal education completed by the primary decision maker was highschool, 16.7 percent completed some undergraduate, 50.0 percent completed an undergraduate degree (most of them in the horticulture area), and 8.3 percent completed graduate studies. Generally, the producers who were unwilling to change appeared to have completed a higher level of education than those producers who were willing to change from their current strategy. However, relationship between education and willingness to change from a current vertical coordination strategy to an alternative was not significant at the .05 level using a chi-square test.

Not surprisingly, producers who were unwilling to change from their current vertical coordination strategy to an alternative were more satisfied with their current strategy than producers who were unwilling to change (a chi-square test was significant at the .05 level). When asked how satisfied they were with their current strategy, no one said they were not satisfied, while 25.0 percent were moderately satisfied and 75.0 percent were strongly satisfied.

When asked whether they or their operation would be in the celery of seed potato business this year, five years from now, ten years from now, and twenty years from now, the percentage of producers who were unwilling to change who said yes decreased from 83.3 percent in 1998, 83.3 percent in 2003, 58.3 percent in 2008, and 33.3 percent in 2018. This decrease in yes percentage was offset for the most part by an increase in the percentage of unknowns. When asked whether they or their operation would be in the seed potato or celery business this year, five years from now, ten years from now, and twenty years from now, the percentage of producers who were willing to change who said yes decreased about the same rate as those producers unwilling to change: from 92.3 percent in 1998, 76.9 percent in 2003, 46.2 percent in 2008, and 30.8 percent in 2018. This decrease in yes percentage was offset for the most part by an increase in the percentage of unknowns. The decision of whether or not to remain in business may be affected by the age of the decision maker. Expecting that the older a decision maker is might be reasonable, the less likely they are to remain in the seed potato or celery business. However, chi-square tests of these relationships were found not to be significant at the .05 level.

5.3 General Findings Based on Qualitative Analysis

Although qualitative analysis of the findings is dispersed through this chapter, the focus of this section is to exploit the richness of the case study method and to cover topics not easily captured quantitatively. The following topics are covered in this section: (1) introductory comments on the general findings based on qualitative analysis, (2) a comparison of producers' theoretically optimal strategies and their current strategies, (3) a typical case where all four decision nodes were yes resulting in a producer's willingness to change vertical coordination strategy, (4) cases where a no at a single decision node resulted in a producer's unwillingness to change vertical coordination strategy, (5) cases where a no at two decision nodes resulted in a producer's unwillingness to change vertical coordination strategy, and (6) cases where a no at three decision nodes resulted in a producer's unwillingness to change vertical coordination strategy.

5.3.1 Introductory comments on the general findings based on qualitative analysis

In Chapter 4, there were four transaction interfaces presented as relevant to producers in the Michigan seed potato and celery industries. The reader may ask what transaction interfaces were studied during the interview stage of this research? Early in the interview process it became apparent Michigan seed potato producers were most interested in discussing strategy at the marketing-buying interface. This was driven in part by the majority of Michigan seed potato producers sell (market) their own seed to buyers, a form of vertical integration at the production-marketing interface.

The majority of Michigan celery producers, as a rule, do not interact directly with celery buyers and the majority of the celery producers belonged to the Michigan Celery Promotion Cooperative. As a result, the most relevant interface for the typical Michigan producer who was unwilling to change from their current strategy takes place at the production-marketing interface versus the marketing-buyer interface. There were a total of 12 production-marketing and 13 marketing-buyer interfaces (not to be confused with the split between willingness and unwillingness to change) represented in this research.

Producers were asked to identify their dominant current vertical coordination strategy at a specified transaction interface. After the respondent's dominant vertical coordination strategy was identified, the majority of the interview focused on understanding how factors of the proposed framework affected the producer's willingness to adopt an alternative strategy. Producers were given the opportunity to choose the alternative strategy which was compared to their current strategy. Table 5.7 gives the frequencies of the different current to alternative strategy combinations which were identified for Michigan celery producers, Michigan seed potato producers, and all producers combined.

A limited number of producers (approximately five) had a hard time deciding which alternative strategy their current strategy should be compared to. In these situations, the investigator offered two or three choices of alternative strategies. The producer was then able to pick an alternative to be studied. Allowing the producer to choose the alternative strategy to be discussed enabled the investigator to assess the programmability of alternative strategies, and also creating a realistic scenario to respond to.

The most common choice of current to alternative strategy was from formal cooperation to a different form of formal cooperation (nine celery producers). Normally, the investigator would not allow the respondent to choose an alternative and current strategy which are nearly the same. The nine celery producers belonged to the same grower cooperative and the current and alternative strategies considered at the production marketing interface involved the cooperative. However, the majority of celery producers saw a distinct difference between belonging to the cooperative and marketing their celery through shippers in a quasi strategic alliance and having the cooperative hire someone specifically to market all the members' celery (a quasi-form of vertical integration).

Table 5.7 Frequency of Current to Alternative Strategy Combinations Chosen by Producers

Current to Alternative Strategy	Celery Frequency	Seed Potato Frequency	Total Frequency
Spot Market to Contract	1	7	8
Spot Market to Formal Cooperation	1	0	1
Contract to Spot Market	0	4	4
Contract to Strategic Alliance	0	1	1
Strategic Alliance to Spot Market	0	1	1
Strategic Alliance to Vertical Integration	1	0	1
Formal Cooperation to Formal Cooperation	9	0	9

Within these nine current strategy as formal cooperation to the alternative strategy as formal cooperation a number of strategy shifts took place. There were four producers who considered a formal cooperation/strategic alliance (current strategy) to a formal cooperation/vertical integration (alternative strategy). Three producers considered a change from formal cooperation/strategic alliance (current strategy) to a formal cooperation/contract (alternative strategy). While, two producers were considering a change from formal cooperation/contract (current strategy) to a formal cooperation/strategic alliance (alternative strategy). This finding supports the statement made in Chapter 2 that formal cooperation strategies offer a rich and complex strategy category which warrants further study.

The next two most common current to alternative strategy combinations were from spot market to contract (one celery and seven seed potato producers) and from contract to spot market (five seed potato producers). These findings also mirror the differences in cooperative attitudes which exist between the Michigan celery producers and the Michigan seed potato producers. Overall it appears Michigan celery producers are more willing to work cooperatively than Michigan seed potato producers. However, this statement must be interpreted carefully because the comparison of strategies between celery and seed potato producers must take place at the same interface. For example, Table 5.7 implies seed potato producers more commonly utilize spot markets than celery producers, but this comparison is based on two different interfaces and two different sets of experiences. Seed potato producers were considering a change from spot markets to contracts at the marketing-buying interface, while celery producers were considering a change from one type of formal cooperation to another type of formal cooperation at the production-marketing interface.

The most talked about strategy in the seed potato industry was contracting. Almost every seed producer interviewed was considering or had at least one experience with contracting. Chapter 4 suggested that large companies such as Frito Lay are responsible in large part, for the increased contract activity. The increased use of contracts throughout the chipping potato value chain is due in part to the increasing levels of nonseparability. This nonseparability in turn, is driven be the need of the value chain to be responsive to the final consumer.

5.3.2 Comparison of producers' theoretically optimal strategies and their current strategies

A comparison of each producer's theoretically optimal strategy[29] and their current strategy revealed only 2 producers out of the twenty-five (8 percent) had a current vertical coordination strategy which corresponded to their theoretically optimal strategy as suggested by their revealed levels of asset specificity and nonseparability. At first glance, this seems a questionable. One would expect to find more than 8 percent of the producers operating at their theoretically optimal strategy if the concept of a theoretically optimal strategy made empirical sense. Does this imply that 23 of the producers just did not have any idea of the appropriate choice of vertical coordination strategy or is the theory incorrect?

There are at least four plausible explanations why only two out of twenty-five producers were engaged in vertical coordination strategies which were the same as their theoretically optimal strategies: (1) the industries represented in the research were undergoing major structural shifts, (2) path dependence was present as slowness to

[29]Theoretically optimal strategies by industry were compared. The weighted average of the type and number of the theoretically optimal strategies were approximately the same. In other words, the total number of contracts, strategic alliances, and formal cooperation strategies were roughly the same for each industry.

change across these industries, and (3) implementability and/or the acceptability of the risk/return tradeoff may be preventing the firm from changing strategy.

The producers interviewed in this research were selected because of their past dealings with the researcher. Leaders representing the producers from the Michigan celery and seed potato industries enlisted the services of Michigan State University and the investigator to help them reposition their respective industries. These industries are struggling to keep up with the rapid changes that are taking place. In this sense it is not surprising that many producers would not be operating at their theoretically optimal strategy.

Both industries have a history of cautious adoption, whether it is the adoption of a new technology or the adoption of an alternative strategy. There are likely to be many reasons for a particular producer's hesitance to change, especially if the change involves increased levels of cooperative activity. In Chapter 4, the reasons for the Michigan seed potato industry's reluctance to adopt a 1993 strategic plan offers many insights into non-adoption including geographic dispersion, differences in ideologies, and the independent nature of producers.

Related to this history of cautious adoption and path dependence is that it is reasonable to assume the majority of current vertical coordination strategies employed by producers were optimal at one time. As the presence and effects of asset specificity and nonseparability continue to strengthen, many producers are just not sure how to react.

One final possible explanation why only 8 percent of the producers were operating at their theoretically optimal strategy is that problems of implementability or the acceptability of the risk/return tradeoff of all programmable alternatives may make adoption prohibitive.

These producers may have cycled through the decision process for changing a vertical coordination strategy and were satisfied that the ability to reduce the costliness of a coordination error, the programmability, implementability, and acceptability of the risk/return tradeoff associated with the current strategy was maximized for their current strategy.

Given the three explanations above, there are valid reasons why more producers had not been operating at their theoretically optimal strategies. Further research would suggest the need for a more finely tuned instrument which may lead to even better predictability in this regard.

5.3.3 A typical case where all four decision nodes were yes resulting in a producer's willingness to change vertical coordination strategy

There were ten producers who indicated their willingness to change from their current strategy to an alternative strategy as a result of all four decision nodes being yes. In these ten cases an alternative was identified as reducing the costliness of a coordination error, effective management routines existed (the alternative was programmable), the alternative was deemed to be implementable, and the risk/return tradeoff of the alternative was acceptable. The proposed framework will be applied to a producer who represents the typical case for those respondents where all four decision nodes were yes and the producer indicated a willingness to change from their current strategy to an alternative. Case number eight, a Michigan seed potato producer has been chosen as the representative case for these ten producers. The producer will be referred to by his case number to maintain confidentiality as promised by the investigator (see Appendix C).

The current strategy used at the marketing-production interface by case number eight was spot market. This seed producer sells his seed potatoes to between ten and fifteen buyers each year. The price he receives for his seed potatoes is set by the spot market. Some years, he can make an adequate return, while other years he sells at near break even. In the last fifteen years, the number of high return years has decreased, and hitting a high price year is more difficult (a sign of general uneasiness regarding his current strategy). When asked how satisfied he was with his current spot market strategy the producer responded, "A seed grower does what he has to do to stay in business, but in general, I am satisfied with selling my seed potatoes on the open market." The alternative strategy case number eight was considering was contracting on a multi year basis with a particular seed potato buyer. This four-year contract was tied to the base contract price the buyer was to receive for his contract with a potato processor.

Based on responses to questions about asset specificity and nonseparability, the producer revealed that contracting would reduce the costliness of a coordination error. Asset specificity for case number eight was low. The producer believed the weather was unique in his geographic area because the short growing season limited the variety of crops (form of temporal asset specificity) which could be economically raised. However, like many of his seed potato counterparts, the producer maintained a limited investment in equipment. The producer even raised some cattle on his farm, as another enterprise and as a home for the cull potatoes. Therefore, the general farm equipment had alternative uses besides seed potato production. This producer also had a small grading line (low physical asset specificity) where he could sell some of his seed potatoes as eating potatoes to the local restaurants and grocery stores in his area.

Nonseparability was moderate for case number eight due to the interaction between a weak standalone competitive advantage, the producer's perception that linkages across the transaction interface were not important, and the producer's moderate need for responsiveness to the final consumer.

Standalone competitive advantage was weak for case number eight because the producer cited the geographic isolation of the growing area as his primary source of competitive advantage. The isolated growing area meant less exposure to disease, such as late blight (a seed producer's worst nightmare since it stops the producer from being able to sell his or her crop). The producer described his potatoes as having northern vigor. Little additional evidence was offered as support for standalone competitive advantage. If the firm needs the cooperation of others in the value chain to achieve and sustain competitive advantage, then the incentive toward intensive (managed) coordination is stronger (this is the situation for case number eight). It is the combination of the vulnerable competitive advantage and the access to linkages (the question is, does case number eight see the importance of these linkages?) on the other side of the transaction interface that leads to nonseparability/complementarity. Without access to linkages (or the inability to take advantage of these linkages) that can overcome or limit the vulnerability of the firm's competitive advantage, the combining of individual activities will not yield an output larger than the sum of output generated by separating the activities.

Case number eight did not see the importance of linkages, except to say that he will do what he has to do to stay in business. This producer did see the need for responsiveness to the final consumer. This was driven in part by his exposure to retail and restaurant sales.

The theoretically optimal strategy suggested under conditions of low asset specificity and moderate nonseparability is specification contract. The direction of shift from the current strategy (spot market) to the alternative (contracting) was toward the theoretically optimal strategy, which is why contracting as an alternative would reduce the costliness of a coordination error for case number eight. The fact that the alternative strategy and the theoretically optimal strategy were the same was another indication that the costliness of a coordination error could be reduced by adoption of the alternative.

The programmability of vertical integration was high for case number eight. In fact, the producer had been involved in contracting on a limited basis with a potato processor prior to their pulling out of Michigan. Contracting with this process allowed the seed potato producer to learn the effective management routines required to contract in the seed potato industry. This past positive experience with contracting played a critical role in case number eight's willingness to contract with a particular potato buyer.

Implementability of vertical integration as an alternative strategy for case number eight was coded as high in this research. The amount of capital needed to contract with a particular buyer was slightly constraining. The seed producer normally begins shipping his seed potatoes to buyers in late March because this is when the weather normally warms up and this producer loads the trucks outside. The contract buyer would prefer to take delivery of these seed potatoes in mid February which will require the seed producer to add a dock to his seed warehouse. Compatibility was cited as one reason the seed potato producer was willing to enter a contract with a particular buyer. The seed producer used words like trust and reputation for dealing fairly when describing the contract with this buyer. The coordination competence of the producer and the institutional acceptability of contracting were not constraining for this transaction at the marketing-buying interface.

The producer believed the risk associated with contracting at the production-marketing interface would be low. There would be a learning curve associated with contracting with a grower versus a processor, but the seed producer was pleased that establishing a contract price over a four-year period would reduce the risk of not having the seed potatoes sold after harvest.

The returns associated with contracting would be the same or slightly greater, but there would also be added costs, such as adding a dock to his warehouse. The other benefit the seed producer saw to contracting over a multi year period was the producer could concentrate at becoming more efficient instead of trying to find a buyer and become more efficient at the same time.

When asked if he would adopt contracting based on the combination of risk and return, the producer said he would, with one caveat. He was unwilling at the time of the interview to commit 100 percent of his crop to one type of vertical coordination strategy. If contracting worked out, he planned gradually to increase the number of acres devoted to contracting.

In summary, the willingness of case number eight to change from spot market to contracting marketing-buying interface was possible because contracting would reduce the costliness of a coordination error, contracting was programmable and implementable, the risk/return associated with contracting was acceptable.

5.3.4 *Cases where a no at a single decision node resulted in a producer's unwillingness to change vertical coordination strategy*

There were three producers who indicated their unwillingness to change from their current strategy to an alternative strategy as a result of a single no at one of the four decision nodes. Interestingly enough, the no appeared at a different decision node for each of the three producers. An alternative that did not reduce the costliness of a coordination error, an alternative which was not implementable, and the unacceptability of the risk/return tradeoff associated with an alternative strategy were the three decision nodes.

The three cases are explored in detail and the framework will be applied explicitly to explain how a single no can result in a producer's unwillingness to change strategy. Each producer will be referred to by their case number to maintain confidentiality.

5.3.4.1 *A case where inability of an alternative to reduce the costliness of a coordination error led to an unwillingness to change strategy*

Based on responses to questions regarding the levels of asset specificity and nonseparability, the producer coded as case number twenty revealed the alternative strategy considered during the interview would not reduce the costliness of a coordination error. In fact, changing to the alternative would increase the costliness of a coordination error. Case number twenty was a celery producer who was involved in a strategic alliance with a local celery shipper at the production-marketing interface. The alternative strategy considered by the producer during the interview was the producer marketing his own celery (a form of vertical integration). As part of the strategic alliance, the producer received a pooled price for his celery on a weekly basis. The shipper sold celery for three other producers. Once a week, the prices received for all four producers were averaged resulting in the price received by case number twenty for his celery.

The relationship between case number twenty and the shipper was based on mutual respect and trust. There was constant communication between the shipper and the producer, which allowed the shipper and the producer to react quickly to the needs of their customers (an indication of the need for responsiveness to the final consumer). The producer indicated the key to the success of this relationship was that the producer and the shipper shared many of the same philosophies regarding marketing (a form of strategic compatibility). The producer indicated he was very satisfied with the strategic alliance as his current strategy at the production-marketing interface.

Asset specificity for case number twenty was low. The producer believed there were many alternative uses for his greenhouses and muck soil other than their use in celery production. The investments made in celery packing equipment were minimal and could be sold to other celery producers if needed. The producer made substantial investments over the years to improve his ability to maintain adequately drained muck soils. The investment in drainage capabilities was seen as a form of competitive advantage by the producer and not as form of increased asset specificity because increased drainage capabilities made the land more attractive for growing other crops such as carrots and onions.

Nonseparability was moderate for case number twenty due to the interaction between a strong standalone competitive advantage, the perceived importance of linkages with other firms in the value chain, and the need for responsiveness to the final consumer. The producer expressed concern that access to markets could be a problem if he were to consider marketing his own celery. This translates into an increased importance for linkages and increased nonseparability at this transaction.

Standalone competitive advantage was strong for case number twenty because the producer used family instead of seasonal help for management positions (skilled labor in management was not too constraining). All of the celery is vacuum cooled before it is shipped to buyers. Many producers claim to pre-cool their product by placing the celery in a cooler for twelve hours, but case number twenty has his celery run through a machine which brings the field temperature of the celery down in a matter of minutes. This vacuum cooling is done within four hours of harvest. Vacuum cooling of celery in this manner results in fewer rejections of shipments from buyers and increases the celery's shelf life and the buyer's confidence in the ability of the strategic alliance to provide top quality celery on a consistent basis. Although the shipper owned the vacuum cooler, and the producer, case number twenty believed so strongly in the idea that he would not ship his celery without pre-cooling.

The theoretically optimal strategy suggested under conditions of low asset specificity and moderate nonseparability is specification contract. The direction of shift from the current strategy (strategic alliance) to the alternative (vertical integration) was away from the theoretically optimal strategy, which is why vertical integration as an alternative did not reduce the costliness of a coordination error for case number twenty.

The programmability of vertical integration was high for case number twenty. In fact, from time to time, this producer has marketed his own celery. Implementability of vertical integration as an alternative strategy for case number twenty was coded as high in this research. However, the verbal cues of this producer could be coded as moderate implementability because of the effects of amount of capital needed and the availability of skilled marketing labor. The producer may lose access to the shipper's vacuum cooler as a result of leaving the strategic alliance and marketing his own celery. Vacuum coolers require a minimum investment of two hundred thousand dollars and the producer was not sure if he wanted to spend this kind of money just for celery during a four-month season (an indication of the interrelatedness between asset specificity and implementability). To be successful at vertical integration at the production-marketing interface, the producer felt he would have to hire someone with produce marketing experience. The producer believed that finding a skilled marketer could be constraining, but surmountable.

The producer believed the risk associated with vertical integration at the production-marketing interface would be moderate. There would be a learning curve associated with selling his own celery. Getting to know buyers and raising enough celery to be a consistent supplier to these buyers could be challenging. In the end, the producer believed he would only succeed at selling his own celery if he could find enough niches in the marketplace.

The returns associated with selling his own celery would be greater, but there would also be added costs. The producer was currently paying a commission to the shipper for marketing his celery. Although the producer would no longer have the cost of a shipper's commission, there would be the added costs of hiring marketing expertise and the costs of maintaining a sales office. In general, the producer believed the savings resulting from not paying commission would be greater than the additional costs associated with marketing his own celery.

When asked if he would adopt vertical integration based on the combination of risk and return, the producer said he could go either way. When pushed for a yes or no answer regarding the adoption of vertical integration, the producer indicated the risk/return tradeoff was slightly better for vertical integration than the risk return associated with the strategic alliance.

In summary, the unwillingness of case number twenty to change from a strategic alliance to vertical integration at the production-marketing interface was due primarily to the inability of the alternative to reduce the costliness of a coordination error. Although the current strategy (strategic alliance) and the theoretically optimal strategy identified (specification contract) were different suggesting a mismatch, the producer believed that the costliness of a coordination error associated with a strategic alliance was acceptable.

5.3.4.2 A case where low implementability of an alternative strategy led to an unwillingness to change strategy

The producer identified as case number thirteen indicated the alternative strategy considered during the interview would not be implementable because of issues of compatibility and institutional acceptability. Case number thirteen was a celery producer who relied primarily on the spot market at the production-marketing interface. The alternative strategy considered by the producer during the interview was joining a celery producer cooperative (a type of formal cooperation). The producer used various shippers to sell his celery. However, the producer tended to use one shipper more than others. The producer was free to sell his celery through any shipper he thought would bring the highest return for his celery.

Occasionally the producer would sell directly to customers, bypassing the shippers (a form of vertical integration). However, the producer believed the risk of bad debt was substantial when selling directly to buyers. In fact, he had received his share of bad debt from buyers who went out business before paying for his celery. Although the producer was fairly satisfied with using the spot market for moving his celery, he often wondered if a better way existed to market his celery.

Costliness of a coordination was high for case number thirteen. The producer believed asset specificity was high. The producer believed there were few alternative uses for his greenhouses because they were older and less adaptable to other uses such as bedding plants. Due to its age, most of the farm's equipment was specific to celery production (other celery producers indicated that newer celery equipment could now be used for other crops). His muck soils, while rich, warmed up relatively slower than the muck soils in other celery growing areas of Michigan (increased physical and temporal asset specificity) which caused the season to start and end later. Missing the early start often meant missing the higher early market prices, while ending later resulted in the majority of buyers sourcing celery from other areas and the increased threat of a freeze in the fall.

Nonseparability was moderate for case number thirteen due to the interaction between a moderate standalone competitive advantage, the perceived importance of linkages with other firms in the value chain, and the need for responsiveness to the final consumer. The producer believed access to markets could be improved by joining a celery marketing cooperative. The producer definitely saw the importance of linkages in the celery value chain (increased nonseparability) at the production-marketing interface. The producer talked about the barriers of getting celery to be as readily accessible as carrots (aware of the need to be more responsive to the final consumer).

Standalone competitive advantage was moderate for case number thirteen because the producer indicated he was technically proficient in celery production. For example, the producer prided himself in being able to get celery from the field, packed in cartons, and in the cooler within two hours from harvest. The producer also planted bare rooted celery versus celery grown in plugs containing soil around the roots. He believed bare rooted celery had more vigor than celery planted from plugs. Since the producer's responses relative solely to competitive advantage arising from production skills which could be imitated, the standalone competitive advantage was coded as moderate.

The theoretically optimal strategy suggested under conditions of high asset specificity and moderate nonseparability is formal cooperation. The direction of shift from the current strategy (spot market) to the alternative (formal cooperation) was toward the theoretically optimal strategy. In fact the alternative strategy was the same as the theoretically optimal strategy, which is why formal cooperation as an alternative would reduce the costliness of a coordination error for case number thirteen.

The programmability of vertical integration was high for case number thirteen. In fact, from time to time, this producer has considered joining a marketing cooperative. The rules and process associated with joining the cooperative were well known by the producer.

Joining the cooperative meant the producer would have to make an all or nothing decision. The cooperative's by laws state that members must sell all of their celery for fresh sales through the cooperative system. The cooperative did not actually market the celery directly, but relied on a form of strategic alliance with selected shippers. The cooperative uses a price committee to set the price the shipper can charge for all cooperative members' celery. While case number thirteen saw the benefit of cooperative marketing, he refused to make an all or nothing decision. In fact, the producer approached the cooperative and asked to be allowed to sell only a percentage of his crop through the cooperative. The cooperative, fearing that allowing one grower to market only a portion of their crop through the cooperative would open the floodgates of other producers who would want to market only part of their crop through the cooperative when it suited their interests, refused to make an exception for case number thirteen.

This refusal to make an exception lead to resentment by case number thirteen and lowered the compatibility between the case number thirteen and the celery marketing cooperative. In the end, case number thirteen said joining the cooperative has merit but he was just not willing to give up so much control over pricing, harvesting and shipping to gain better access to celery markets.

The producer believed the risk associated with vertical integration at the production-marketing interface would be moderate. There would be a learning curve associated with marketing celery through a cooperative. The moderate riskiness associated with joining a cooperative was based on case number thirteen's desire to adopt the strategy incrementally.

The returns associated with selling his own celery would be slightly higher because he would gain access to more celery shipper, but there would also be added costs. Added costs would be incurred if case number thirteen had to ship his celery across the state to the shipper's docks instead of shipping out of case number thirteen's cooler.

When asked if he would join the celery marketing cooperative based on the combination of risk and return, the producer said yes he would adopt. The producer indicated the risk/return tradeoff was better for joining the celery marketing cooperative versus the risk return associated with the spot market.

In summary, the unwillingness of case number thirteen to change from a spot market to joining a celery marketing cooperative at the production-marketing interface was due primarily to the inability to overcome the constraint of institutional acceptability. This refusal to change strategy also illustrated the incremental nature of strategy adoption. If the celery marketing cooperative had been willing to allow case number thirteen to commit only a portion of his crop to the cooperative, he would have joined the cooperative and perhaps even decided to market all of his celery through the cooperative. Even though the alternative strategy (formal cooperation) and the theoretically optimal strategy identified (formal cooperation) were the same, this was not enough to cause case number thirteen to be willing to change vertical coordination strategy.

5.3.4.3 A case where the risk/return tradeoff associated with an alternative strategy led to an unwillingness to change strategy

The producer identified as case number twenty two indicated the risk/return tradeoff associated with an alternative strategy considered during the interview was unacceptable. Case number twenty two was a former celery producer who now concentrates on the growing and marketing of onions. Case number twenty two relied primarily on the spot market at the marketing-buying interface. The alternative strategy considered by the producer during the interview was contracting on a yearly or multi-year basis with onion buyers (a type of specification contract). The producer sold onions to many different buyers and was free to sell his onions to any buyer he thought would bring the highest return for his onion crop.

Costliness of a coordination error was high for case number twenty two. The producer believed asset specificity was high. Everything he did on the farm was geared toward becoming a better onion grower and marketer. The producer purchased specialized equipment with few alternative uses for growing, storing, and packing onions (a form of physical asset specificity). The producer indicated that selling these assets would recover only a small portion of the investments made in them.

Nonseparability was moderate for case number twenty two due to the interaction between a strong standalone competitive advantage, the perceived importance of linkages with other firms in the value chain, and the need for responsiveness to the final consumer. The producer saw the importance of linkages in the onion value chain (increased nonseparability) at the production-marketing and marketing-buying interfaces. For example, case number twenty two currently acts as the sole marketer of onions for three onion growers besides himself. Case number twenty two is driven by the need to be the "onion supplier" for his customers year round. Accomplishing this requires case number twenty two to link with other onion growers as well as being responsive to the needs of onion buyers and the final onion consumer.

Standalone competitive advantage was high for case number twenty two because the producer indicated he was technically proficient in celery production and marketing. For example, the producer is in the onion business year round. During the Michigan onion season, and especially after it is over, case number twenty-two sources onions from other growing areas including Idaho, Texas, Mexico, and South America to meet the needs of his customers. Reaching the economies of size and ability to store is difficult for other onion producers and his ability to market onions year round is what led to coding case number twenty two as possessing a strong standalone competitive advantage.

The theoretically optimal strategy suggested under conditions of high asset specificity and moderate nonseparability is formal cooperation. The direction of shift from the current strategy (spot market) to the alternative (specification contract) was toward the theoretically optimal strategy. One would expect contracting as an alternative to reduce the costliness of a coordination error for case number twenty two.

The programmability of specification contracts was high for case number twenty two. In fact, from time to time, buyers have asked this producer to enter contracts. Until now, case number twenty two has resisted politely these buyer requests, primarily out of concern that adopting an alternative strategy based on contracting would lead to an unacceptable risk/return tradeoff.

Implementability of specification contracting as an alternative strategy was coded as high for case number twenty two in this research. Compatibility with potential partners and the mismatch between the producer's revealed coordination characteristics and the alternative strategy (contract) being considered were found to be factors leading to lower implementability of this alternative. Case number twenty two believed that less compatibility is needed at the spot market compared to the compatibility needed to contract at the marketing-buying interface in the onion industry. The producer stated he believed there was less compatibility today between marketers and sellers than existed in the past, but compatibility would not be overly constraining for specification contracting.

The producer believed the risk associated with specification contracting at the production-marketing interface would be moderate. There would be a learning curve associated with marketing onions via contracts. There are non performance risks associated with contracts. Case number twenty two wondered what the ramifications would be if he would be unable to honor a contract due to circumstances outside his control. The producer was comfortable with his firm's ability to market onions via spot market transactions.

The returns associated with selling his own onions would be much lower because the producer believes he probably cannot capture the highs and lows of the market under contracting. Case number twenty-two even drew a simple graph which illustrating the fluctuations of the onion market. He then drew another line to represent the average returns associated with the fluctuations. He drew a final line to show the returns associated with contracting. This line was just below the average return line suggesting that on average, the contract price is set just below the average returns earned in the spot market.

When asked if he would adopt contracting as an alternative strategy based on the combination of risk and return, the producer said he would not adopt. The producer indicated the risk/return tradeoff decision was easy to calculate as being unacceptable because the risk was higher and the return was lower

In summary, the unwillingness of case number twenty two to change from a spot market to contracting at the marketing-buying interface was due primarily to the unacceptability of the risk/return tradeoff. This refusal to change strategy may be modified by an incremental adoption of contracting in the future. Although the case number twenty two prefers to operate in spot markets, he realizes that he may have to enter contracts to better meet the needs of his customers and the final consumer. Although the current strategy (spot market) and the theoretically optimal strategy identified (formal cooperation) were different suggesting a sizeable mismatch, the producer believed that the costliness of a coordination error associated with a spot market was acceptable versus the alternative of a specification contract.

5.3.5 Cases where a no at two decision nodes resulted in a producer's unwillingness to change vertical coordination strategy

There were four producers who indicated their unwillingness to change from their current strategy to an alternative strategy as a result of an alternative not reducing the costliness of a coordination error and the unacceptability of the risk/return tradeoff. There were no other combinations of two nos resulting in a producer's unwillingness to change strategy.

The key similarities and differences between these four cases are explored in the context of the framework to explain how two nos can result in a producer's unwillingness to change strategy. Each producer will be referred to by their case number to maintain confidentiality as promised. Three of the four producers were seed potato producers operating at the marketing-buying interface, while one was a celery producer operating at the production-marketing interface.

All four of these producers were satisfied with current strategy. These current strategies included strategic alliance (case number one), contract (case number four), formal cooperation as a contract (case number twenty three), and contract (case number twenty five). A word of explanation regarding formal cooperation as a contract. Case number twenty three was a celery producer who belonged to the celery marketing cooperative discussed in the last section. This producer contracted the majority of his celery crop to a processor. The interaction between the producer and the processor is contractual, while the cooperative grants permission to the producer to contract the majority of his crop with the processor, and the balance of his crop is processed by the cooperative itself. Three of the four producers were using some form of contract as their current strategy. The alternative strategy selected by three of the four producers was spot market, while the fourth, a celery producer, was using a form of formal cooperation which resembled a spot market.

Costliness of a coordination error was high for all four producers. The three seed potato producers indicated high levels of asset specificity and moderate levels of nonseparability, while the celery producer indicated that asset specificity was moderate and nonseparability was low. High levels of asset specificity arose from the nature of the seed potato business in general and from an individual producer's investment and commitment to serving the needs of their customers better than average producers in their industry. The perishable nature of seed potatoes (temporal asset specificity), the increasing complexity of buyers (customer specificity), and specialized planting and harvesting equipment (physical asset specificity) employed in seed are faced by all Michigan seed potato producers.

Nonseparability would have been coded as high for the three seed potato producers based on their common ability to see the need for linking with partners throughout their value chains and their common desire to be responsive to the final consumer. The moderating effect on nonseparability was the strong standalone competitive advantage each of these three seed potato producers possessed. The reader may recall that a firm with a strong standalone competitive advantage is better positioned to employ strategies using a lower intensity of control than firms who possess a weak standalone competitive advantage. The celery producer has assets which had other uses (greenhouses which were used to raise bedding plants and celery). The celery producer had a relatively weak standalone competitive advantage which primarily based on his technical ability to grow celery, and he saw little importance for linking with others across the production-marketing interface, and little need to be responsive to the final consumer.

All four producers were considering alternative strategies which moved them away from (as opposed to moving toward) their theoretically optimal strategy. The three seed potato producers revealed their optimal strategy was formal cooperation, while the celery producer's theoretically optimal strategy was contracting.

The risk/return tradeoff associated with the alternative strategy considered by each of the four producers was unacceptable. Each of the four producers indicated that the alternative they were considering would result in higher risk than their current strategy and lower returns than their current strategy. The combination of the risk and return associated with the alternative strategies was readily seen to be unacceptable.

5.3.6 Cases where a no at three decision nodes resulted in a producer's unwillingness to change vertical coordination strategy

There were four producers who indicated their unwillingness to change from their current strategy to an alternative strategy as a result of an alternative not reducing the costliness of a coordination error, low implementability of the alternative, and the unacceptability of the risk/return tradeoff. Since programmability of an alternative was high for all twenty-five producers interviewed, three nos implies the alternative strategy had many problems from the producer's point of view.

The key similarities and differences between these four cases are explored in the context of the framework to explain how three nos can result in a producer's unwillingness to change strategy. Two of the four producers were seed potato producers operating at the marketing-buying interface and two were celery producers operating at the production-marketing interface.

All four of these producers were satisfied with current strategy. These current strategies included contract (case number three and case number six), formal cooperation as a strategic alliance (case number sixteen), and formal cooperation as a contract (case number twenty four) A word of explanation regarding formal cooperation as a strategic alliance. Case number sixteen was a celery producer who belonged to the celery marketing cooperative discussed in the last section. This producer sold the majority of his celery to shippers designated by the cooperative. The cooperative sets the prices the shippers may accept from buyers for the members' celery. Three of the four producers were using some form of contract as their current strategy.

The alternative strategy selected by the two seed potato producers was spot market. The two celery producers chose formal cooperation as vertical integration (the cooperative was to replace the current shippers with a salesperson that worked just for the cooperative) and formal cooperation as a strategic alliance. All four producers considered alternative strategies which were only one category away from their current strategy. This was common across all twenty-five producers who were interviewed and this suggests there is likely to be some from of comfort zone (choice set) that decision makers consider when changing a vertical coordination strategy.

While the costliness of a coordination error was relatively high for all four producers, it was lower, with one exception (one seed potato grower had high asset specificity and moderate nonseparability), for these four producers than for the producers who had nos at two decision nodes. The two seed potato producers (case numbers three and six) indicated high levels of asset specificity, while the two celery producers (case numbers sixteen and twenty-four) indicated moderate asset specificity. The reasons for the difference between asset specificity in the seed potato and celery industries were stated in section 5.4.4.

Nonseparability was low for three of the four producers, and moderate for the fourth (case number three). In general, the three producers who expressed low nonseparability saw little importance to linking with others across the transaction interface and little need to be responsive to the final consumer.

All four producers were considering alternative strategies which moved them away from (as opposed to moving toward) their theoretically optimal strategy. One seed potato producer (case number three) revealed their optimal strategy was formal cooperation, while the other seed potato producer and the two celery producer's theoretically optimal strategy was contracting.

One seed potato producer (case number six) and one celery producer (case number twenty four) indicated that implementability of the alternative strategy they were considering would be constraining as a result of the overall effect of the four components of implementability. The combined influence of capital, compatibility, competence, and institutional acceptability resulted in low implementability. The other seed potato producer (case number three) and the other celery producer (case number sixteen) expressed capital and compatibility constraints as contributing the most to low implementability. Both producers were considering an alternative strategy which required the hiring of marketing expertise. These producers questioned whether such expertise could be found.

Case number sixteen was a celery producer who exhibited a considerable amount of path dependence when it came to considering alternative vertical coordination strategies. This producer remembered what it was like to be in the celery industry before the cooperative was formed. He said it was a nightmare, in that shippers were playing pricing games which caused problems among the celery producers. This image of the industry before the cooperative was strong enough to affect any strategy that would change the role of the celery cooperative.

The risk/return tradeoff associated with the alternative strategy considered by each of the four producers was unacceptable. Three of the four producers indicated that the alternative they were considering would result in higher risk than their current strategy and lower returns than their current strategy. One seed potato producer believed the returns associated with the spot market would be equal to or slightly less than the returns from contracting. All four producers were quick to respond that the combination of the risk and return associated with the alternative strategies was unacceptable.

5.4 Relevance of the Qualitative Research Findings to the Proposed Framework

This section of the chapter will apply the insights and findings presented throughout the thesis to the testing of the four research propositions. The four decision nodes of the proposed framework are evaluated regarding the decision process for altering a vertical coordination strategy. The cases cited for the decision node analysis can be found in Table 5.8. This is followed by discussion regarding the qualitative testing of the research propositions. The section concludes with an evaluation of the four research propositions.

5.4.1 The implications of the findings regarding whether or not an alternative strategy reduces the costliness of a coordination error

If an alternative strategy reduces the costliness of a coordination error, then a change in vertical coordination strategy may be warranted. This is how decision node one is worded in the proposed framework, but how important a factor was it in the twenty-five cases? There were ten producers who indicated that the alternative strategy they were considering would not reduce the costliness of a coordination error. Each of the ten producers was also unwilling to change from their current strategy to an alternative. Therefore, a non-reduction of the costliness of a coordination error was an excellent predictor (100 percent) of a producer's unwillingness to change from their current strategy to an alternative in this research.

Of the ten producers who indicated that the alternative strategy would not reduce the costliness of a coordination error, only in one case was this the only decision node correlated with a producer's unwillingness to change from their current strategy to an alternative. In five other cases, where the alternative strategy would not reduce the costliness of a coordination error there was at least one other decision node which also

Table 5.8 The Relationship Between the Willingness to Change and the Four Decision Variables on a Case-by-Case Basis

Case No.	Change Observed?	Producer Response At Decision Nodes			
		Node 1 (a)	Node 2 (b)	Node 3 (c)	Node 4 (d)
1	No	No	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes
3	No	No	Yes	No	No
4	No	No	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes
6	No	No	Yes	No	No
7	Yes	Yes	Yes	Yes	Yes
8	Yes	Yes	Yes	Yes	Yes
9	Yes	Yes	Yes	Yes	Yes
10	Yes	Yes	Yes	Yes	Yes
11	Yes	Yes	Yes	Yes	Uncertain
12	Yes	Yes	Yes	Yes	Uncertain
13	No	Yes	Yes	No	Yes
14	Yes	Yes	Yes	Yes	Yes
15	Yes	Yes	Yes	Yes	Yes
16	No	No	Yes	No	No
17	Yes	Yes	Yes	Yes	Yes
18	No	No	Yes	No	Uncertain
19	Yes	Yes	Yes	Yes	Uncertain
20	No	No	Yes	Yes	Uncertain
21	Yes	Yes	Yes	Yes	Yes
22	No	Yes	Yes	Yes	No
23	No	No	Yes	Yes	No
24	No	No	Yes	No	No
25	No	No	Yes	Yes	No

(a): Does an alternative strategy reduce the costliness of a coordination error?
(b): Is the alternative programmable?
(c): Is the alternative implementable?
(d): Is the risk/return tradeoff of the alternative acceptable?

suggested the producer would be unwilling to change from their current strategy to an alternative. In four cases, where the alternative strategy would not reduce the costliness of a coordination error there were two other decision nodes which also suggested the producer would be unwilling to change from their current strategy to an alternative.

Although this decision node characterized by whether or not an alternative strategy will reduce the costliness of a coordination error, performed as expected (a single no at this decision node was hypothesized to result in an unwillingness to change strategy), most of the time a producers' unwillingness to change strategy was based on multiple decision nodes which were also no.

Fifteen producers indicated that the alternative strategy they were considering would reduce the costliness of a coordination error. In thirteen of these fifteen cases (87 percent of the time), the producer also indicated their willingness to change from their current strategy to an alternative. Reducing the costliness of a coordination error was thus a good predictor of a producer's willingness to change. It was less than perfect, but then an alternative had to pass three other decision nodes (resulting in a yes) before a producer was willing to change strategy.

5.4.2 The implications of the findings on the programmability decision node

Programmability was high for each producer without exception. Each respondent indicated effective management routines existed for the alternative they were considering. Programmability will be shown in the next section to support the research propositions, but little else can be said regarding its effect on the willingness of a producer to change vertical coordination strategy. However, programmability may still have an important role to play in the decision making process which was not captured effectively by the interview and research design. Possible strategies for improving the measurement of this variable will be discussed in the final chapter.

Decision makers were aware of effective management routines which they could adopt if they were interested in altering their current vertical coordination strategy. All of the producers readily cited two or more alternative strategies from which they could choose. Occasionally, the respondent may not have been sure how to go about adopting a given alternative strategy, but they could all think of ways to learn more about adopting an alternative. For example, a respondent may not know how to write up a contract with a buyer. Nevertheless, they did have an idea of where to go or who to talk to in order to make the alternative more programmable.

Programmability is likely to become more important in the decision process for altering a vertical coordination strategy as the underlying structure of value chains continues to evolve. For example, the coordination of the chipping potato value chain from genetics to consumer by companies such as Frito Lay is a good example of how one form of programmability, access to these kinds of value chains, may change the effective management routines required to participate in such value chains.

Given the non varying values of programmability, relative to the choice of an unwillingness or willingness to change a current strategy, the overall importance of the programmability decision node could neither be strongly stated, nor dismissed summarily. There are enough reasons not to drop programmability from the proposed framework prior to additional refinement and testing.

5.4.3 The implications of the findings on the implementability decision node

If an alternative strategy is implementable, then a change in vertical coordination strategy may be warranted. This is how decision node three is worded in the proposed framework, but how important a factor was it in the twenty-five cases? There were six producers who indicated that the alternative strategy they were considering was not implementable. Each of the six producers were also unwilling to change from their current strategy to an alternative. Therefore, an alternative strategy that was not implementable was an excellent predictor (100 percent) of a producer's unwillingness to change from their current strategy to an alternative in this research.

Of these six producers who indicated that the alternative strategy was not implementable, only in one case was this the only decision node correlated with a producer's unwillingness to change from their current strategy to an alternative. In one other case, where the alternative strategy was not implementable there was at least one other decision node which also suggested the producer would be unwilling to change from their current strategy to an alternative. In four cases, where the alternative strategy was not implementable, there were two other decision nodes which also suggested the producer would be unwilling to change from their current strategy to an alternative.

Although this decision node characterized by whether or not an alternative strategy was implementable, performed as expected (a single no at this decision node was hypothesized to result in an unwillingness to change strategy), most of the time a producers' unwillingness to change strategy was based on multiple decision nodes which were nos.

Eighteen producers indicated that the alternative strategy they were considering was implementable. In thirteen of these eighteen cases (72 percent of the time), the producer also indicated their willingness to change from their current strategy to an alternative. Increasing the implementability of an alternative strategy was thus a fair predictor of a producer's willingness to change. Again, three other decision nodes also had to be positive in order to insure change.

5.4.3.1 General findings regarding capital, compatibility, and competence as implementability issues

Neither the amount of, nor access to capital required for the adoption of an alternative strategy was significantly different between those groups who exhibited an unwillingness to change strategy and those groups who exhibited a willingness to change strategy. These findings should not be interpreted as the amount of capital and access to capital are unimportant considerations in the strategy decision making process, in part, because producers were allowed to choose the alternative strategy to be compared against their current strategy. The majority of the producers (68%) chose alternatives which involved movements which were only one strategy category away from each other on the continuum. For example, the current strategy of one respondent was spot market, while the alternative was contracting. The very nature of the alternative being considered required little change in the amount of, or access to capital. However, a couple of producers indicated that obtaining operating capital was easier based on their current strategy (contracting) than it would be if they were to adopt a spot market alternative.

Another reason for the relatively minor effect of the amount of and access to capital was related to producers who belonged to a cooperation as the current strategy. Nine out of the twenty-five producers or 36 percent belonged to the Michigan Celery Promotion Cooperative. All nine of these cooperative members chose alternative strategies which involved cooperative effort in one form or another. These nine producers generally indicated an alternative strategy which required a reasonable amount of and access to capital would not be constraining for the cooperative as a whole. The ability of cooperative to combine the resources of its members can lead to higher levels of capital compared to the capital available to an individual producer.

When asked how constraining the need for compatibility was, producers exhibiting an unwillingness to change from their current strategy were not significantly different (based on the chi-square test) from those who indicated a willingness to change from their current strategy to an alternative. This was surprising, if not disappointing to the investigators. There are at least two possible explanations for compatibility not being a significant variable in the analysis. First, in retrospect the compatibility questions were designed poorly. Separating what the respondent was including in their answers to the compatibility questions was difficult. For example, when a respondent said compatibility would not be constraining when considering a strategy change from spot markets to contracting, was this because they already had high compatibility with those firms they were planning to contract with? The explanatory power of compatibility may increase if the focus is on possible mismatches between revealed compatibility and the hypothesized need for compatibility of an alternative strategy.

Second, many of the producers made comments such as the following when asked about how constraining compatibility would be: "You need to find compatible partners no matter what strategy you are choosing." While this is a valid statement, this research sought to discern between a more narrowly defined concept of compatibility based on cultural and strategic factors, than on the broad concept of compatibility indicated by producer comments.

Many of the celery decision makers' (the majority of whom belonged to a cooperative) responses illustrated the influence a cooperative can have on decision making. Cooperative members were often heard to say just how difficult implementation of a given alternative strategy could be because they believed some of their fellow members would oppose the adoption of a given strategy. There was a tendency to second guess how other cooperative members would respond to a given question. Sometimes, this estimations of what other members were likely to do became constraining to the point of preventing adoption of the alternative strategy. Compatibility with available partners within and across organizations requires further study.

Finally, the availability of skilled labor was considered constraining for some of the producers. Most notably, skilled labor was found more constraining for those alternative strategies which involved additional marketing activities (e.g., switching from a contract where the marketing is set ahead of time, to vertical integration of the marketing function where the decision maker would have to market their own products). The lack of skilled labor is a general problem facing all producers in the Michigan seed potato and celery industries.

5.4.3.2 Concluding remarks regarding the implementability decision node

The concept of implementability in the decision process for altering a vertical coordination strategy needs to be refined further. For example, the investigator found it difficult to convey the definition of institutional acceptability in a meaningful way. All too often, decision makers associated institutional acceptability with the latest government regulation such as the Food Quality Protection Act. Other variables such as compatibility also need refinement. The research did support the construct validity decision node three (the implementability decision node) in that all of the data gathered during the interview process was easily coded into variables which were assigned either directly or indirectly to the four variables pertaining to implementability. As a result, coding of the data did not reveal any missing components.

Based on the information gathered in this research, there was moderate evidence to accept the importance of decision node three which states if the need for, or access to capital, the coordination competence of a decision maker, the compatibility between the decision maker and his/her firm and potential partners, and the institutional acceptability of the alternative strategy are found not to be overly constraining, in total or in part, then an alternative strategy is considered implementable and a change in vertical coordination strategy may be warranted.

5.4.4 The implications of the findings on the acceptability of the risk/return decision node

If the risk/return tradeoff of an alternative strategy is acceptable, then a change in vertical coordination strategy may be warranted. This is how decision node four is worded in the proposed framework, but how important a factor was it in the twenty-five cases? There were nine producers who indicated that the risk/return tradeoff associated with an alternative strategy they were considering was not acceptable. Each of the nine producers was unwilling to change from their current strategy to an alternative.

Therefore, an unacceptable risk/return tradeoff of an alternative strategy was an excellent predictor (100 percent) of a producer's unwillingness to change from their current strategy to an alternative in this research.

Of these nine producers who indicated that the risk/return tradeoff of the alternative strategy was unacceptable, only in one case was this the only decision node correlated with a producer's unwillingness to change from their current strategy to an alternative. In four other cases, where the risk/return of the alternative strategy was unacceptable, there was at least one other decision node which also suggested the producer would be unwilling to change from their current strategy to an alternative. In four other cases, where the risk/return tradeoff of an alternative strategy was unacceptable, there were two other decision nodes which also suggested the producer would be unwilling to change from their current strategy to an alternative.

Although this decision node characterized by whether or not the risk/return tradeoff of an alternative strategy was acceptable, performed as expected (a single no at this decision node was hypothesized to result in an unwillingness to change strategy), most of the time a producers' unwillingness to change strategy was based on multiple decision nodes which were nos.

A total of eleven producers indicated that the risk/return tradeoff associated with an alternative strategy they were considering was acceptable. In ten of these eleven cases (91 percent of the time), the producer also indicated their willingness to change from their current strategy to an alternative. Thus an acceptable risk/return tradeoff was a good predictor of a producer's willingness to change. Again, three other decision nodes also had to be positive in the node to assume a change in strategy.

Based on the result from the twenty-five cases in this research, three of the four decision nodes help to explain the decision process for altering a vertical coordination strategy.

5.4.5 Qualitative testing of the validity of the research propositions

In Chapter 3 four research propositions arose out of the proposed framework regarding the decision process for altering a vertical coordination strategy. The last section of this chapter offered evidence for the strong support of the individual decision node variables. This section builds upon the earlier sections and offers justification for strong support for three of the four research propositions, and moderate support for the remaining research proposition. The four research propositions are:

RP_1: If: (1) an alternative strategy reduces the costliness of a coordination error, and (2) the alternative strategy is programmable, and (3) the alternative strategy is implementable, and (4) the risk/return tradeoff of the alternative strategy is acceptable, then a change in vertical coordination strategy will occur.

RP_2: If: (1) an alternative strategy does not reduce the costliness of a coordination error, or (2) the alternative strategy is not programmable, or (3) the alternative strategy is not implementable, or (4) the risk/return tradeoff of the alternative strategy is unacceptable, then a change in vertical coordination strategy will not occur.

RP_3: If a change in vertical coordination strategy has occurred, then: (1) an alternative strategy has reduced the costliness of a coordination error, and (2) the alternative strategy was programmable, and (3) the alternative strategy was implementable, and (4) the risk/return tradeoff of the alternative strategy was acceptable.

RP_4: If no change in vertical coordination strategy has occurred then: (1) an alternative strategy did not reduce the costliness of a coordination error, or (2) the alternative strategy was not programmable, or (3) the alternative strategy was not implementable, or (4) the risk/return tradeoff of the alternative strategy was unacceptable.

5.4.5.1 *The relationship between the willingness to change and the four decision variables*

The case by case findings from the interview process will be presented in this section. Along with summary statistics that show how well the findings map into the four research propositions. Given the indirect testing of the research propositions required in this research, outlining the logic used between the actual research propositions and the variables which were coded upon completion of the interview process would be useful. Table 5.9 highlights the logic employed to convert the research propositions into the dichotomous coding used directly to test the four research propositions.

In Table 5.10 the research proposition statement that a change in vertical coordination strategy is equivalent for testing purposes to their willingness or unwillingness to change from their current strategy to an alternative. Does an alternative strategy reduce the costliness of a coordination error was translated directly from the variable label into the research proposition and coded as no or yes.

The final three components of the four research propositions were also straightforward in their interpretation as research propositions, interview variable labels, and the table code used in Table 5.9. For example, the risk/return tradeoff of the alternative strategy was acceptable corresponds to will the producer adopt, given the risk/return tradeoff (no, uncertain, or yes) was coded in Table 5.9 as no, uncertain, or yes.

Perhaps the strongest evidence given for the strong support of research propositions one, two, and four, and the moderate support for research proposition three is shown in Table 5.10. In this table the relationship between a change in strategy (represented as the willingness of a producer to change from their current strategy to an alternative strategy) and the four decision variables (costliness of a coordination error, programmability,

Table 5.9 Converting the Research Proposition Statements Into Dichotomous Codes

Research Proposition Statement	Variable Label	Table Code
If a change in vertical coordination strategy will occur	Willingness to change	Yes
If a change in vertical coordination strategy will not occur	Unwillingness to change	No
An alternative strategy reduces the costliness of a coordination error	An alternative strategy reduces the costliness of a coordination error	Yes
The alternative strategy was programmable	Level of programmability was high	Yes
The alternative strategy was implementable	The level of implementability was high	Yes
The risk/return tradeoff of the alternative strategy was acceptable	Adopt, given the risk/return tradeoff of the alternative was yes or uncertain	Yes or Uncertain
An alternative strategy does not reduce the costliness of a coordination error	An alternative strategy does not reduce the costliness of a coordination error	No
The alternative strategy was not programmable	Level of programmability was low	No
The alternative strategy was not implementable	The level of implementability was low	No
The risk/return tradeoff of the alternative strategy was unacceptable.	Adopt, given the risk/return tradeoff of the alternative was no or uncertain	No or Uncertain

implementability, and acceptability of the risk/return tradeoff) are expressed as frequencies. These frequencies state the number and percentage of cases which correctly predicted the direction of causality as stated by each of the four research propositions.

The testing of research proposition one revealed that in ten out of ten cases, when: (1) an alternative strategy reduces the costliness of a coordination error, and (2) the alternative strategy is programmable, and (3) the implementability of the alternative strategy is high, and (4) the risk/return tradeoff for the alternative strategy is acceptable, there will be a change in vertical coordination strategy (represented by a willingness to change). This is extremely strong evidence for the support of research proposition one.

The percentage of correctly classified cases used in the testing of research proposition two was also 100 percent. Twelve out of twelve cases showed when: (1) an alternative strategy does not reduce the costliness of a coordination error, or (2) the alternative strategy is not programmable, or (3) the alternative strategy is not implementable, or (4) the risk/return of the tradeoff of the alternative is not acceptable, then no change in vertical coordination strategy will occur (represented by an unwillingness to change). This is strong evidence that research proposition two should be accepted (not rejected). Research proposition two is a statement of the necessary condition for no change in strategy to occur.

Table 5.10 Frequencies of the Relationship Between the Willingness to Change and the Four Decision Variables

Case No.	Change Observed?	Producer Response At Decision Nodes				Research Proposition			
		Node 1 (a)	Node 2 (b)	Node 3 (c)	Node 4 (d)	RP_1	RP_2	RP_3	RP_4
1	**No**	No	Yes	Yes	No		✔		✔
2	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
3	**No**	No	Yes	No	No		✔		✔
4	**No**	No	Yes	Yes	No		✔		✔
5	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
6	**No**	No	Yes	No	No		✔		✔
7	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
8	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
9	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
10	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
11	**Yes**	Yes	Yes	Yes	Uncertain			Miss	
12	**Yes**	Yes	Yes	Yes	Uncertain			Miss	
13	**No**	Yes	Yes	No	Yes		✔		✔
14	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
15	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
16	**No**	No	Yes	No	No		✔		✔
17	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
18	**No**	No	Yes	No	Uncertain		✔		✔
19	**Yes**	Yes	Yes	Yes	Uncertain			Miss	
20	**No**	No	Yes	Yes	Uncertain		✔		✔
21	**Yes**	Yes	Yes	Yes	Yes	✔		✔	
22	**No**	Yes	Yes	Yes	No		✔		✔
23	**No**	No	Yes	Yes	No		✔		✔
24	**No**	No	Yes	No	No		✔		✔
25	**No**	No	Yes	Yes	No		✔		✔
Number of cases supporting the research proposition						10/10	12/12	10/13	12/12
Percent of cases supporting the research proposition						100%	100%	77%	100%

(a): Does an alternative strategy reduce the costliness of a coordination error?
(b): Is the alternative programmable?
(c): Is the alternative implementable?
(d): Is the risk/return tradeoff of the alternative acceptable?
Miss implies that the decision node 4 could not be used as support for or against research proposition 3

In ten out of thirteen cases where the producer indicated a change in strategy (represented as a willingness to change), all four decision variables were yes. This resulted in 77 percent of the cases being correctly classified as predicted by research proposition three. Research proposition three is reprinted here for the reader's convenience:

> RP_3: If a change in vertical coordination strategy has occurred, then: (1) an alternative strategy has reduced the costliness of a coordination error, and (2) the alternative strategy was programmable, and (3) the alternative strategy was implementable, and (4) the risk/return tradeoff of the alternative strategy was acceptable.

This is relatively strong evidence that research proposition three should be accepted (not rejected). Research proposition three is a statement of sufficiency condition for a change in strategy which has occurred.

A review of the three mis-classified cases (denoted as Miss in Table 5.10) indicated at situation were the producer had stated they were uncertain about adopting the alternative strategy based on the risk/return tradeoff associated with the alternative variable. A response of uncertain meant the producer could go either way (adopt or not adopt). Therefore, these cases were not counted as supporting research proposition three, but they do not contradict research proposition three outright..

Research proposition four was predicted correctly in 100 percent of the cases. Research proposition four is restated here:

> RP_4: If no change in vertical coordination strategy has occurred then: (1) an alternative strategy did not reduce the costliness of a coordination error, or (2) the alternative strategy was not programmable, or (3) the alternative strategy was not implementable, or (4) the risk/return tradeoff of the alternative strategy was unacceptable.

Twelve out of twelve times when there was no change in vertical coordination strategy (represented as an unwillingness to change), at least one of the four decision variables was also no. Being uncertain about the acceptability of the risk/return tradeoff did not prevent any producer from exhibiting a willingness to change. In those cases where the producer was uncertain about the risk/return tradeoff and they were unwilling to change, there was at least one other decision variable which was a no. There where only two cases where any one no resulted in a no change, four cases where two no's resulted in no change, and four cases where three no's resulted in no change. This is extremely strong evidence for the support of research proposition four. Research proposition four is a statement of the sufficiency condition when a change in strategy does not occur.

5.4.5.2 *Missing cases and the four decision variables*

While the results presented for support of three of the four research propositions are strong and encouraging, there are a number of missing cases (see Table 5.11) which could change the overall effectiveness of the proposed framework. Since there were four decision variables, each with two levels (yes or no), a total of 16 different combinations would be possible.

Table 5.11 shows that only five out of the sixteen possible combinations were represented in the case results. However, eight of the eleven missing result from the problem of having no low programmability cases. Given the nature of the four decision variables, there is no reason a priori to expect any of the combinations not to have been observed. Decreasing the number of missing cases identified above could be accomplished by doing more cases and refining the variables (especially programmability).

5.4.6 Concluding remarks regarding the qualitative analysis of the interview responses

The findings of the previous sections in this chapter can and should be used as general support for the research propositions. Costliness of a coordination error, risk/return acceptability, and the implementability variables were found to be highly predictive of the willingness of a respondent to change their current strategy.

In additional to questions based on the four decision variables, producers were each asked to respond to the following question at the end of the interview process:

> If you were:
> (a) uneasy or unsatisfied with your current business strategy, and
>
> (b) you knew of, or could conceive of management routines which could assist you in the adoption of an alternative business strategy, and
>
> (c) if capital, compatibility with available partners, your business philosophy, your management style, and government influences were not constraining, or could be overcome, and
>
> (d) the risk/return tradeoff of a alternative business strategy was equal to or greater than the risk/return tradeoff of your current business strategy would you change from your current business strategy to an alternative? Yes_____ No_____Why or why not?

This question was designed to test the overall validity of the framework regarding the decision process for altering a vertical coordination strategy. All twenty-five of the producers stated the above series of statements accurately and completely described the process of changing a vertical coordination strategy. This is evidence that there was agreement between the twenty-five producers regarding the four decision factors of the proposed framework regarding a change in vertical coordination strategy. However there may be other factors that were not addressed or thought of by the producers during the interview process.

Table 5.11 Missing Cases and the Four Research Propositions

Possible Combinations				Number of Cases
Alternative reduce the costliness of a coordination error?	**Is the alternative programmable?**	**Is the alternative implementable?**	**Is the risk/return tradeoff acceptable?**	
No	No	No	No	0
No	No	No	Yes	0
No	No	Yes	No	0
No	Yes	No	No	4
Yes	No	No	No	0
No	No	Yes	Yes	0
No	Yes	Yes	No	4
Yes	Yes	No	No	0
No	Yes	No	Yes	0
Yes	No	Yes	No	0
Yes	No	No	Yes	0
No	Yes	Yes	Yes	0
Yes	No	Yes	Yes	0
Yes	Yes	Yes	No	1
Yes	Yes	No	Yes	1
Yes	Yes	Yes	Yes	10
Combinations including uncertainty				5
			Total	25

5.5.1 Cross tabulations and the Pearson chi-square test to find variables which differ between groups

Cross tabulation and the Pearson chi-square test (see Table 5.12) for independence were used to test the null hypothesis that the event of an observation being in a particular column (in this research, a column corresponds to either the low or willingness of changing a strategy) is independent of that same observation being in a particular row (in this research, a row corresponds to interview questions). The Pearson chi-square test involves using the chi-square distribution to approximate the underlying exact distribution. Although the chi-square approximation can be used under a variety of assumptions, the approximation becomes better as the expected cell frequencies grow larger. The approximation may become inappropriate for contingency tables with expected cell frequencies of less than five (PROPHET StatGuide 1998). In the case of a 2X2 contingency table, an adjusted value of the chi-square statistic (the Yates corrected chi-square) is used by SPSS (Norusis 1994) and other statistical packages to correct for a continuous distribution being used to approximate the discrete distribution of the values in the contingency table.

5.5.2 Variables found to be statistically correlated with differences between unwillingness and willingness to change from a current strategy

The null hypothesis used in this chi-square test was: producers who exhibited an unwillingness and those producers who exhibited a willingness of changing from their current strategy to an alternative responded to the questions in Table 5.12 the same way. If the null hypothesis can be rejected by the Pearson chi-square test, then there is quantitative evidence that willingness producers and unwillingness producers did not answer a given question in the same way. Variables which were constructed from the interview responses are presented separately from those variables which were coded directly from interview questions.

At a .05 probability level, the null hypothesis was rejected (i.e., unwilling and willing producers did not answer these questions the same way) for the following questions constructed from interview questions:

- Does the alternative strategy being considered by the producer reduce the costliness of a coordination error (no or yes)?
- What is the level of implementability of the alternative strategy being considered (low or high)?
- What is the perceived size of the strategy shift from the current to the alternative strategy being considered (small or large)?
- What is the level of mismatch between the revealed coordination characteristics and the alternative strategy (small or large)?

The four questions listed above, are also found in Table 5.12. These questions represent those variables constructed from the responses of other variables.

At the end of each interview the investigator assigned a value to the perceived size of the strategy shift (small or large) being considered by the producer. This coding was based on verbal cues given the producer during the interview. Upon reflection of the respondent's answers to the interview questions, the investigator was confident in his ability to identify the perceived size of shift in strategy being considered by individual producers. For example, statements such as "I do not think switching to a contract will be difficult because I have been contracting a small part of my crop already" were coded as a small perceived shift in strategy. Comments like "I am not sure if I could find a good

Table 5.12 Differences in Interview Responses by Unwillingness and Willingness of a Strategy Shift Based on the Pearson Chi-Square Test Statistic Significant at the .05 Probability Level

Question	Response Category	Unwillingness		Willingness		Satisfies Chi-square?
		"n"	Row %	"n"	Row %	
Does an alternative strategy reduce the costliness of a coordination error?	No	2	13.3	13	86.7	✓
	Yes	10	100.0			
What is the implementability of the alternative strategy?	Low	6	100.0			✓
	High	6	31.6	13	68.4	
What is the perceived size of the strategy shift being considered?	Small	4	26.7	11	73.3	✓
	Large	8	80.0	2	20.0	
What is the level of mismatch between the revealed coordination characteristics and the alternative strategy?	Low	4	28.6	10	71.4	✓
	High	8	72.7	3	27.3	
What is the level of satisfaction with the current strategy?	Not			1	100.	✓
	Moderate	3	23.1	10	76.9	
	Highly	9	81.8	2	18.2	
How sustainable is the competitive advantage?	Weak	2	28.6	5	71.4	✓
	Moderate	2	25.0	6	75.0	
	Strong	8	80.0	2	20.0	
How constraining is the uncertainty surrounding the alternative strategy?	Not			8	100.	✓
	Slightly	1	25.0	3	75.0	
	Moderate	1	50.0	1	50.0	
	Very	6	85.7	1	14.3	
How risky is the proposed alternative strategy?	Low	1	11.1	8	88.9	✓
	Moderate	2	28.6	5	71.4	
	High	9	100.			
How constraining is the expected profit potential[30] of the alternative strategy?	Not			8	100.	✓
	Slightly	3	42.9	4	57.1	
	Moderate	2	66.7	1	33.3	
	Very	4	100.			
	Extremely	3	100.			
How will the expected returns of the alternative compare to the current strategy?	Lower	9	81.8	2	18.2	✓
	Same	1	20.0	4	80.0	
	Higher	2	22.2	7	77.8	

[30] This variable was found to fail the normality test at the .10 level.

Table 5.12 (cont'd)?

Question	Response Category	Unwillingness		Willingness		Satisfies Chi-square?
		"n"	Row %	"n"	Row %	
Would the respondent adopt the alternative strategy based on its risk/return tradeoff?	No Unsure Yes	9 2 1	100. 40.0 9.1	 3 10	 60.0 90.9	✓
How many acres of land were rented in 1997?	<150 150-750 >750	6 2 4	35.3 50.0 100.	11 2 0	64.7 50.0 0.0	at .10 level
How many years has the respondent been in the business?	≤35 >36	3 10	23.10 76.9	9 3	75.0 25.0	✓
Number of people on the management team	less than 3 3 or more	3 9	25.0 75.0	9 4	69.2 30.7	✓

salesperson if I decided to market the celery myself" were coded as a large perceived shift in strategy.

The remaining questions were asked directly during the interview process and were found to reject the null hypothesis (i.e., unwilling and willing producers did not answer these questions the same way) as well:

- Are you satisfied are you with your current strategy? Yes or no? Why or why not (coded as low moderate or high)?
- If you were to get out of the business, how hard would it be for you to find alternative uses for you assets, including your knowledge and skills (coded as low or high asset specificity)?
- Describe what your firm does well relative to others and state how easy or difficult it is for others to copy or utilize the activities or skills just described (coded as weak, moderate or strong sustainability of stand-alone competitive advantage).

- When you think about switching from your current strategy to the alternative you identified, how constraining is the uncertainty surrounding the alternative as it pertains to adoption of this alternative (5 point Likert scale[31])?

- Having just talked about uncertainty, I would now like you to consider risk. How risky would it be to adopt the alternative strategy you identified (low, moderate or high)?

- When you think about switching from your current strategy to the alternative you identified, how constraining is the profit potential of the alternative as it pertains to adoption of this alternative (5 point Likert scale)?

- Do you think you could increase your returns or profits by adopting the alternative business strategy you identified (coded as lower, same or higher expected returns)?

- When you consider the combination of risk and expected returns of your current business strategy, could this risk/return tradeoff be improved by adopting the alternative business strategy you spoke of (coded as no, unsure or yes adoption based on the risk/return tradeoff)?

- How many years have you or your family been involved in this business (responses ranged from zero to 115 years and coded into two categories)?

- How many people are on your management team? Include spouses when appropriate (responses ranged from zero to ten and were coded into two categories).

- What was the total number of rented acres you farmed in 1997 (responses ranged from zero to 6,000 and were coded into three categories)?

Only one question asked directly in the interview was not significant at the .05 level for the Pearson chi-square test: how many acres of land were rented in 1997 (significant at the .10 level for the Pearson's chi-square).

[31]The 5-point Likert scale used in this research asked the respondent to indicate how constraining the factor was (not constraining, slightly constraining, constraining, very constraining, extremely constraining)

5.5.3 Summary and interpretation of the chi-square test

A review of the cross-tabulation shows which firm-level factors are related to an unwillingness or to a willingness of changing from a current strategy to an alternative. A brief overview of these relationships includes:

(1) The reduction in costliness of a coordination error from adoption of an alternative strategy being considered tends to be lower for those producers exhibiting an unwillingness to change from their current strategy.

(2) The acceptability of the risk/return tradeoff seems lower for those producers exhibiting an unwillingness to change from their current strategy.

(3) The perceived implementability of the alternative strategy considered was found lower for those producers exhibiting an unwillingness to change from their current strategy.

(4) High levels of satisfaction with the current strategy, and high levels for the perceived size of the strategy shift were associated with producers exhibiting an unwillingness to change from their current strategy.

(5) Producers exhibiting an unwillingness to change from their current strategy appeared to rent more land, have been in the business longer, and have more people on their management teams.

The cross-tabulations reveal several key points about the relationships underlying the decision making process regarding the choice of vertical coordination strategy, especially as this process pertains to the willingness to change an existing vertical coordination strategy. There are clear differences between producers who exhibit an unwillingness of change and those that exhibit a willingness of change. These differences are manifested in statistically significant variables representing three of the four decision nodes of the proposed framework. Only the decision node regarding the programmability of the alternative proved not to be statistically different between unwilling and willing producers.

Individual variables identified as pertaining to the decision node known as the acceptability of the risk/return tradeoff can be used in direct association with the willingness to change a given strategy. Higher levels of uncertainty or riskiness were associated with a lower willingness to change. The more constraining the perceived potential for profit was related to a lower willingness of change. Lower expected returns and lower willingness to adopt the alternative strategy based on the anticipated risk/return tradeoff were linked to lower willingness to change from a given strategy to an alternative.

The larger the mismatch between the revealed coordination characteristics (i.e., invisible hand, managed, or a combination of invisible hand and managed characteristics) of the producer and the alternative strategy being considered, the less willing producers were to change their vertical coordination strategy. This admittedly imprecise instrument for assessing the relationship between a producer's coordination characteristics and willingness to change performed surprisingly well. The percentage of time a high mismatch mapped into an unwillingness to change, or a low mismatch mapped into a willingness to change was correctly classified 16 out of 25 times (64 percent).

Although higher acreage of rented land was positively associated with a lower willingness to change strategy, one must be careful when interpreting this variable. It may be reasonable to assume commitments made to obtain rented land are often multi-year arrangements which are hard to break. Changes of strategy that could fail may be viewed as unacceptable given the commitments made for rented land. The other factor to consider regarding this variable is based on outliers. On respondent who exhibited an unwillingness of changing stated they rented approximately 6000 acres of land in 1997, this acreage was much higher than the rented acreage reported by the other producers.

Increased years in the business and larger management teams were associated with lower willingness to change a given strategy. This seems to make sense in that decision makers with many years of experience may be less likely to seek out alternatives, especially if they have tried the alternative in the past. One might also argue the more people involved in the decision making process, the harder it will be to change a strategy. The levels of complexity in the decision making process tend to increase geometrically with increasing management team size.

The observed associations provide guidance in the drafting of, and give legitimacy to proposed hypotheses about causal relationships between independent and dependent variables. However, cross-tabulations can only measure associations between variables. Statistically-based assertions about causality cannot be established on these comparisons alone (Sterns 1997: p. 206). Even when the Pearson chi-square test is statistically significant, all that is known is that the two groups of producers (those unwilling to change and those willing to change) differed in how they answered interview questions. The relationship between the perceived size of the strategy shift and willingness of change does not prove the direction of the causality, or even if causality exists. For instance, does the perception of a smaller shift in strategy result in a willingness to change, or does a respondent who exhibits a willingness to change perceive the shift in strategy to be smaller?

In the end, cross-tabulations can be no more than a starting point in the quantitative analyses of the relationships between the willingness to change a strategy and the four decision nodes of the proposed framework. The next step, is to draft and test hypotheses of causation. The relationships just identified in the cross-tabulations form the basis of these hypotheses.

5.6 Quantitative Analysis of the Interview Responses Based on Discriminant Analysis

Qualitative observations reported as simple frequencies from the case studies provided strong support for the four research propositions. Building on the insights gained from the cross-tabulations and qualitative analysis reported earlier in this chapter, this section extends the analysis of the in-depth interview data base by using discriminant analysis. This analytic tool was employed to examine how the variables in the interview data base are related, and, when the data permit, to assign causality about the decision process for altering a vertical coordination strategy.

Logistic regression was discussed in Chapter 3 as an appropriate quantitative tool for analyzing the interview responses. Given the number of low or zero cell counts due in part to the relatively small number of cases (25), logistic regression was of limited use in this research. In the last section, sixteen possible combinations of the four decision variables in their dichotomous form were identified. Logistic regression requires a minimum of three observations per cell to be a reliable statistical measure of the data. With only twenty-five cases, this was not possible.

Logistic regression functions based on individual decision variables did yield results which supported the discriminant analysis findings to presented in this section. However, when two or more variables were included in the logistic regression function, the estimates of the coefficients became unreliable. Therefore, quantitative analysis of the interview responses in this section is limited to discriminant analysis.

Most econometric models use dependent variables that are continuous in nature (e.g., yields, earnings, price-quantities). However, some research questions such as those posed here lend themselves more readily to a limited number of fixed, discrete responses.

In these cases, the discrete responses are modeled as qualitative dependent variables, and specific econometric modeling and regression analyses are needed that accommodate the statistical limits of having a dependent variable that is not continuous.

The reason economists have recognized the importance of qualitative response models is that the models' structures are particularly well suited for examining yes/no choices (e.g., decisions to purchase, or to participate in the labor force) and/or selections made from a small number of alternatives (e.g., voting or transportation options). The simplest form of these models has a univariate dichotomous yes/no dependent variable. More complex models have polychotomous dependent variables (both ordered and unordered), or multivariate models where the probabilities of a pair of choices are examined jointly (Sterns 1997: p. 219).

5.6.1 Creation of trichotomous costliness of a coordination error and implementability variables

Quantitative methods such as discriminant analysis lend themselves to variables which may be more than dichotomous in nature. The qualitative analysis of the last section focused on the dichotomous form of the four decision variables (independent variables). Given the exploratory nature of this research adopting a trichotomous form of the independent variables may be appropriate and lead to a more precise measurement and refined understanding of the decision process for altering a vertical coordination decision.

In particular, the costliness of a coordination error and implementability variables lent themselves to trichotomous coding. Just as in dichotomous coding, a shift from a current strategy to an alternative was coded as not reducing the costliness of a coordination error if this shift was in a direction that was different from the direction of the shift denoted by moving from an alternative to a producer's theoretically optimal strategy. Under trichotomous coding, an alternative was coded as maybe reducing the costliness of a coordination error if the shift from a current strategy to an alternative was in the same direction as the shift denoted by moving from an alternative to a producer's theoretically optimal strategy. An alternative strategy was coded as reducing the costliness of a coordination error when the alternative and the theoretically identified strategies were identical.

The implementability variable was converted from a dichotomous to a trichotomous variable by looking at the distribution of standardized scores (see section on variable descriptions at the beginning of this chapter) and selecting three ranges of values which followed a natural break between three categories. Therefore, scores greater than zero were coded as low implementability (no change from the dichotomous form). Scores between minus one and zero were coded as moderate implementability, and scores greater than or equal to minus one were coded as exhibiting high implementability.

This section begins with a discussion of the underlying assumptions of discriminant analysis which must be satisfied. This is followed by the development and testing of the discriminant functions. The findings are reported and interpreted in light of the research propositions of Chapter 3. The discriminant analysis model assesses the relationships between the willingness of changing a given vertical coordination strategy and the various proposed independent explanatory variables used to describe Michigan celery and seed potato producers interviewed during this research. The objective of this analysis was to test further and refine the hypothesized relationships among the four decision nodes of the proposed framework and the process used by a decision maker in considering alternative vertical coordination strategies.

5.6.2 Application of discriminant analysis to the interview data base

The first step in discriminant analysis is to select the cases to be included in the computations. A case is excluded from the analysis if it contains missing information for the variable that defines the groups or for any of the predictor variables (Norusis 1994: p.3). If many cases have missing values for at least one variable, the actual analysis will be based on a small subset of cases. Estimates based on small samples are usually quite variable and if the cases with the missing values differ from those without missing values, the resulting estimates may be too biased. Variables gathered from the twenty-five in-depth interviews in this research were complete, which allowed the number of cases to be used in discriminant analysis to equal twenty-five.

5.6.2.1 Testing for multivariate normality

The linear discriminant function minimizes the probability of mis-classification, if in each group the variables are from multivariate normal distribution and the covariance matrices for all groups are equal. A variety of tests for multivariate normality are available. A simple tactic which was used initially in this research was to examine the distributions of each of the variables individually. If the variables are jointly distributed as multivariate normal, it follows that each is individually distributed normally. However, even if all variables are normally distributed, the joint distribution is not necessarily multivariate normal (Norusis 1994: p. 36).

In order to test multivariate normality more directly, new variables were created based upon the variables used in a particular discriminant function. For example, the group of variables used in a particular discriminant function included the costliness of a coordination error mismatch between the theoretically optimal strategy and the alternative strategy, the implementability of the alternative strategy, the level of uncertainty of the alternative, and a measure of the profitability of the alternative strategy. These four variables were added to create a new variable called Normal3. Normal3 was found to be multivariate normal when tested for univariate normality based on the Shapiro-Wilk's test. SPSS uses the Lilliefors significance correction to adjust for small sample size when testing for normality. This procedure was used to determine multivariate normality for each of the discriminant functions reported in this research.

5.6.2.2 Testing for equal group covariance

The Box's M test, which is based on the determinants of the group covariance matrix, was used to test the equality of the group covariance matrices. The Box's M test is designed to test the null hypothesis that the covariance matrices are equal. A small probability (e.g., at the .05 level) might lead an investigator to reject the null hypothesis that the covariance matrices are equal. However, when sample sizes in the groups are large, the significance probability may be small even if the group covariance matrices are not too dissimilar. This was not a concern in this research since the sample size was relatively small at 25. The Box's M test may also lead to a rejection of the null hypothesis, and a belief that the covariance matrices are unequal if the multivariate normality assumption is violated.

For the group of variables comprising the discriminant functions which were deemed to approximate a normal distribution, the Box's M test revealed a significance level of .422. Therefore, the null hypothesis which stated that the population covariance matrices were equal for a producer's unwillingness and willingness to change from their current strategy to an alternative could not be rejected. The Box's M procedure was used to check for the presence of equal group covariance matrices in all of the discriminant functions used in this research.

5.6.2.3 Testing the equality of the group means

It is always useful to begin analyzing the differences between groups by examining univariate statistics. The goal here is to determine whether the observed differences between the two sample means (one pertaining to producers who exhibited an unwillingness, and the other pertaining to producers who exhibited a willingness to change strategy) was due to random variations from one sample to the next, or whether the data came from populations where the means were truly different (Iversen and Norpoth 1987: p. 11). One could compare the group means according to each predictor variable.

The statistical null hypothesis tested with F values, states the two means of the two primary groups in this study are equal. The decision whether or not to reject this hypothesis is based on how likely it is that the two known sample means differ by as much as they do or more, if it is really true that the population means are equal. When the dependent variable is dichotomous (as it is here: low or willingness) the F values are just the square of the t values from the two-sample t test (Norusis 1994: p. 4). The main difference between the F values and t values from the two-sample t test is that F values allow for different observations for the groups being studied. Therefore, the means of all the variables listed in Table 5.13 have been found statistically different between those producers who exhibited an unwillingness of change and those producers who exhibited a willingness of changing strategies.

The first univariate test conducted was a one-way ANOVA procedure designed to test the hypothesis that all group means are equal (see Table 5.13). If the significance level is less than 0.05, the hypothesis that all group means is equal is rejected (Norusis 1994: p. 4). Table 5.13 is a list of all the variables in the interview data base that passed the F-test, and as a result became potential discriminating variables.

All the variables used in the discriminant analysis passed the F test at the .05 level except two variables: (1) level of asset specificity (.057) and (2) years in the potato or celery business (.057). One caveat is in order. A variable passing the F test would not necessary be included in a test run a priori. The variable must first pass the "sense" test. For example, the level of asset specificity was significant at the .10 level. However, the level of asset specificity is important in calculating the reduction of the costliness of a coordination error, and has no direct interpretation as a discriminant variable for discerning between unwillingness and willingness to change strategy.

5.6.2.4 Wilks' lambda and allocating the total variance of the dependent variable

Another useful univariate statistic is Wilk's lambda. When variables are considered individually, as in Table 5.13, lambda is the ratio of the within-groups sum of squares to the total sum of squares. A lambda of one occurs when all observed group means are equal. Values close to zero occur when within-groups variability is small compared to

Table 5.13 Tests of Equality of Group Means Based on the Willingness to Change

Variable	Wilks' Lambda	F value	Sig.
Does an alternative reduce the costliness of a coordination error (No or Yes)	.420	31.708	.000
Does an alternative reduce the costliness of a coordination error (No, Maybe, or Yes)	.450	28.161	.000
Level of asset specificity (Low, Moderate, or High)	.852	4.006	.057
Sustainability of competitive advantage (Weak, Moderate, or Strong)	.800	5.759	.025
Would you adopt the alternative strategy based on the risk/return? (No, Uncertain, or Yes)	.352	42.428	.000
Is uncertainty constraining? (Not to Extremely constraining)	.345	43.721	.000
How risky is the alternative? (Low, Moderate, or High)	.430	30.464	.000
Is the potential for profit constraining? (Not to Extremely constraining)	.418	32.070	.000
Will the returns of the alternative be higher? (Lower, Same, or Higher)	.705	9.609	.005
Implementability of the alternative (Low and High)	.658	11.960	.002
Implementability of the alternative (Low, Moderate, or High)	.701	9.798	.005
External Competence mismatch w/ Alternative (Low or High)	.808	5.482	.028
Satisfaction w/ current strategy (No, Moderate, or Strong Yes)	.647	12.569	.002
Perceived size of strategy shift (Small or Large)	.726	8.659	.007
Acres of rented land in 1997 (3 categories)	.798	5.834	.024
Years in the potato or celery business	.851	4.031	.057
Number of people on management team (2 Categories)	.804	5.594	.027

total variability. That is, when most of the total variability is attributable to differences between the means of the groups. Thus large values of lambda suggest that group means do not appear to be different, while small values suggest that group means do appear to be different (Norusis 1994: p. 5). The variable used to identify whether or not the respondent believed they would adopt an alternative strategy based on the risk/return tradeoff has a Wilks' lambda of .352 which implies this variable had high explanatory power in regarding differences in willingness to change.

The pooled within-groups correlation matrix measures the interdependencies among the variables used in the discriminant analysis. However, one must be careful when interpreting the standardized and unstandardized discriminant function coefficients in the presence of highly correlated variables, since correlations between variables affect the magnitudes and signs of the coefficients (Norusis 1994: p. 19). Table 5.14 presents the pooled-within group correlation matrix corresponding to the three decision variables found in the first discriminant function presented later in the chapter.

The pooled within-groups correlation matrix is obtained by averaging the separate correlation matrices for all groups and then computing the correlation matrix. Table 5.14 shows only moderate evidence of correlation of the three primary framework variables found to be significant in distinguishing between willingness to change groups. The highest correlation is between uncertainty and the potential for profit variables (.285).

Table 5.15 shows the total correlation matrix for the three primary framework variables which ended up in the final discriminant analysis. Total correlations between these three variables are much higher than the pooled within-groups correlation. For example, the total Pearson correlation between the reduction of the costliness of a coordination error and the uncertainty variable is .159, and is significant at the .01 level. Our primary interest in correlation will be based on the pooled within-group statistics, not on the total correlation statistics.

Table 5.14 Pooled Within-Groups Correlations Matrix

	Reduction of the costliness of a coordination error	Alternatives implementable?	Is uncertainty constraining?	Is the potential for profit constraining?
Reduction of the costliness of a coordination error	1.000	.079	.159	.124
Alternatives implementable?	.079	1.000	-.165	.247
Is uncertainty constraining?	.159	-.165	1.000	.285
Is the potential for profit constraining?	.124	.247	.285	1.000

The results printed in Table 5.15 support the assertion that the acceptability of the risk/return tradeoff is influenced by the ability of an alternative to reduce the costliness of a coordination error, and the level of implementability of an alternative strategy. The total correlation matrix in Table 5.15 shows the costliness of a coordination error variable is positively and significantly related to the risk/return variables: (1) is uncertainty constraining (.663), and is the potential for profit constraining (.620). Implementability is negatively and significantly correlated with uncertainty (-.524) and negatively, but not significantly correlated with profit potential (-2.84).

Table 5.15 Total Correlation Matrix

	Reduction of the costliness of a coordination error	**Alternatives implementable?**	**Is uncertainty constraining?**	**Is the potential for profit constraining?**
Reduction of the costliness of a coordination error	1.000	-.361	.663(**)	.620(**)
Alternatives implementable?	-.361	1.000	-.524(**)	-.284
Is uncertainty constraining?	.663(**)	-.524(**)	1.000	.726(**)
Is the potential for profit constraining?	.620(**)	-.284	.726(**)	1.000
** Correlation is significant at the 0.01 level (2-tailed).				

5.6.3 *Calculating and interpreting the discriminant functions*

While descriptive statistics and univariate tests of significance provide basic information about the distributions of the variables in the groups and help to identify some differences among the groups, the emphasis here is on analyzing the variables together, not one at a time. By considering the variables simultaneously, we can incorporate important information about their relationships. In discriminant analysis, a linear combination of the independent variables is formed and serves as the basis for assigning cases to groups. Discriminant analysis establishes weights on the predictor variables so they result in the best separation between the groups. The linear discriminant equation is represented by: $D=B_0 + B_1X_1 + B_2X_2 + \ldots B_pX_p$ where the X's are the values of the predictor variables and the B's are coefficients estimated from the data.

If discriminant analysis is to distinguish between two or more groups, these groups must differ in their D values. Therefore, betas are chosen so the values of the discriminant function differ as much as possible between the groups, or so that for the discriminant scores, the ratio (between-group sum of squares ÷ within-groups sum of squares) is a maximum (Norusis 1994: p. 7). Returning to the three decision variables, the equation for the discriminant function would be: $D=-4.369 + .814X_1 -.747X_2 +.430X_3 + .569X_4$.

Where

D = is the discriminant score
X_1 = the costliness of a coordination error variable,
X_2 = the implementability variable,
X_3 = the uncertainty variable, and
X_4 = the profitability variable.

The coefficients for the discriminating variables were taken from the unstandardized coefficient matrix generated by SPSS.

The discriminant score is calculated from the discriminant function by multiplying the unstandardized coefficients by the values of the variables, summing these products, and adding the constant. Interpreting the meaning of the discriminant function is done by examining the relative positions of the data cases and group centroids (the multidimensional space for this discriminant function defined by the means of each variable for each group) and by studying the relationships between the individual variables and functions. If a respondent indicated an alternative would reduce the costliness of a coordination error (coded as a 1), a high level of implementability (coded as a 3), uncertainty as being slightly constraining (coded as a 2), and the potential for profit as being moderately constraining (coded as a 3), the resulting discriminant score would be: $D=-4.369 + .814*(1) - .747*(3) +.430*(2) + .569*(3)$. When totaled, this equation equals

-3.229 which is well in the neighborhood of the grand centroid of -1.822 for a willingness to change from a current to an alternative strategy.

5.6.3.1 *Eigenvalues, canonical correlation, and the Wilk's lambda measures of discriminant function efficiency*

One indicator of effectiveness of the function of the actual discriminant scores in the groups. A "good" discriminant function is one that has much between-groups variability when compared to within-groups variability. Discriminant analysis chooses the coefficients of the discriminant function so that the ratio of the between-groups sum of squares to the within-groups sum of squares is as large as possible.

Eigenvalues are simply the ratio of between groups sum of squares divided by the within-groups sum of squares. The larger the eigenvalue, the greater the discriminating power of the function. The eigenvalue associated with the four decision variables of Table 5.16 is 3.907.

The canonical correlation is a measure of the degree of association between the discriminant scores and the groups. The canonical correlation for a discriminant function is the square root of the ratio of the between-groups sum of squares to the total sum of squares. Squared, the canonical correlation is the proportion of the total variability explained by differences between groups. The canonical correlation for the four decision variables is .892. When squared, the canonical correlation shows approximately 80 percent of the total variability explained by differences between unwillingness or willingness to change groups.

Table 5.16 Discriminant Analysis Results: Decision Variables Passing the Normality and Equal Covariance Tests

Variable Group	Values
	Structure Matrix Coefficients
Uncertainty of the alternative (Not constraining to Extremely constraining)	.698
Profitability of the alternative (Not constraining to Extremely constraining)	.597
Reducing Costliness of a Coordination Error (No, Maybe, Yes)	-.560
Implementability (Low, Mod, High)	-.330
Grand Centroids	Unwilling= 1.973 Willing = -1.822
Eigenvalue	3.907
Canonical Correlation	.892
Wilk's Lambda	.204
Variation Explained Between Groups	80%
Variation Explained Within Groups	20%
Percent of Cases Correctly Classified Original Group	92%
Percent of Cases Correctly Classified Cross-validated	88%

Wilk's lambda is the ratio of the within-groups sum of squares to the total sum of squares. It is the proportion of the total variance in the discriminant scores not explained by differences among groups. Lambda plus the canonical correlation squared by definition equals one. A word of caution is in order here. Even though Wilk's lambda may be statistically significant, it provides little information about the effectiveness of the discriminant function in classification. It only provides a test of the null hypothesis that the population means are equal. Small differences may be statistically significant but still not permit good discrimination among the groups (Norusis 1994: p. 17). The four decision variables had a Wilks' lambda of .204, which implies approximately 20 percent total variance in the discriminant scores was not explained by differences among groups, but by differences between the low and willingness groups.

5.6.3.2 Interpretation of the structure matrix coefficients

Unstandardized coefficients which were used to determine the discriminant score are the multipliers of the variables when they are expressed in the original units, while standardized coefficients are used when the variables are standardized to a mean of zero and a standard deviation of one. The structure matrix coefficients presented in Table 5.16 are arranged in order of absolute correlation with the discriminant function.

Variables with large coefficients can be thought to contribute more to the overall discrimination function, if the variables do not differ greatly in the units in which they are measured. However, the signs of the coefficients can tell us which variables result in large and small function values. For example, the uncertainty variable (.698) is positive which suggests that the more constraining uncertainty becomes, the larger the discriminant function values. For this discriminant function, larger values of the discriminant function are associated with an unwillingness to change. Therefore, alternative strategies which are perceived as containing more uncertainty will result in an increased likelihood of a respondent being classified as exhibiting an unwillingness to change their current strategy.

As the expected profit potential of the alternative strategy becomes more constraining (.597), the producer is more likely to become unwilling to change from their current strategy. An alternative strategy that reduces the costliness of a coordination error (-.560) is also associated with a willingness to change, and increased levels of implementability (-.330) are associated with an increased willingness of the producer to change from their current strategy.

Correct interpretation of the signs of the structure matrix coefficients depends on the signs of the grand centroids for the two groups in this research. Table 5.16 shows the grand centroid for unwillingness is positive, while the sign for willingness to change is negative in discriminant function.

The structure matrix also provides insight into the relative importance each of the discriminating variables plays in the differences between the groups being studied. Uncertainty had the largest absolute value (.698), followed by how constraining the expected profit was (.597), whether or not an alternative reduced the costliness of a coordination error (-.560), and implementability (-.330) which corresponds to the relative importance of each variable in this discriminant function. Uncertainty, expected profit and the costliness of a coordination error variable, were all close in absolute size or close in their correlation with the discriminant function.

Based on this finding, the sequential nature of the proposed framework represented as four distinct decision nodes may not be the best way to represent the decision making process for altering a vertical coordination strategy. At the end of this chapter, an alternative representation of this decision making framework is presented where the decision nodes are considered in parallel, rather than sequentially.

5.6.3.3 Classification of expected group membership

Discriminant analysis allows the investigator to obtain the number of mis-classified cases. For each group considered, SPSS output shows the numbers of correct and incorrect classifications. The percentage of cases classified correctly is often taken as an index of the effectiveness of the discriminant function. The higher percentage of correct case classification, the more predictive power the estimated discriminant function would have.

A model usually fits the sample from which it is derived better than it will fit another sample from the same population. Thus, the percentage of cases classified correctly by the discriminant function is an inflated estimate of the true performance in the population, just as R^2 is an overly optimistic estimate of a model's fit in regression. If a sample size is large enough, one can obtain a better estimate of the true mis-classification rate by randomly splitting the sample into two parts. Unfortunately, this was not practical given the small sample size.

Another technique for obtaining an improved estimate of the mis-classification rate is the jackknife method, sometimes called the leaving-one-out method. This involves leaving out each case in turn, calculating the function based on the remaining n-1 cases, and then classifying the left-out case. Since the case being classified is not included in the calculation of the function, the observed (or apparent) mis-classification rate is a less biased estimator of the true one (Norusis 1994: p. 15). Returning to Table 5.16, 92 percent of the original cases were correctly classified, while 88 percent of the cross-validated cases of the leaving-one-out method were correctly classified using only three primary framework variables. In an upcoming section, the percent of cases predicted may be improved with the addition of other discriminating variables, besides the decision variables.

Observed mis-classification rates should always be viewed in light of the results expected by chance. For example, if the sample you are studying has two groups, the investigator may have reason to assume the expected prior probabilities to be equal. In other words, the investigator believes a priori the cases in the sample have a 50-50 chance of being assigned to either group. A discriminant function with an observed mis-classification rate of 50 percent is performing no better than chance. In fact, if the rate is based on the sample used for deriving the function, it is probably doing worse.

In this research, the investigator had no theoretical reasons to adjust the expected prior probabilities. As a result they were left at the default setting in SPSS which in the case of two groups is an expected prior probability of 50 percent for each group. The classification rates of 92 and 88 percent respectively, are considerably better than chance.

5.6.4 Discriminant analysis findings

The purpose of this section is to present the remainder of the findings based on the discriminant analysis of the decision variables and seven additional discriminant functions which incorporated variables from the interview process in addition to the decision variables.

The section begins with the general findings and implications of the various discriminant analysis functions. Discriminant functions which failed to meet the normality and equal covariance tests are briefly presented, as well as the results of a step-wise discriminant analysis procedure. The implication of these findings on each of the four decision nodes is discussed.

5.6.4.1 *The general implications of discriminant analysis based on the decision variables*

Table 5.16 was used to illustrate the application of discriminant analysis to the interview data base. The signs on the variables in Table 5.16 make sense intuitively. An increase in the level of uncertainty and how constraining expected profits are, leads to an unwillingness to change. A reduction in the costliness of a coordination error and increases in the implementability of the alternative result in higher levels of willingness to change. This particular combination of variables in the discriminant function provide good, but not great predictive ability. The percent of cases correctly identified was 92 percent for the original group and 88 percent for the cross-validated cases.

Interpreting the results of Table 5.16 uncertainty, expected profit and the reduction of the costliness of a coordination error were clearly all important factors in the decision process to alter a vertical coordination strategy. A case could be made for placing the acceptability of the risk/return tradeoff (based off the structure coefficients for uncertainty, expected profit, and the adopt given the risk/return) ahead of the reducing the costliness of a coordination error variable in the proposed framework. However, the differences in the structure coefficients are relatively close, which supports thinking of this decision process as being a parallel versus sequential.

5.6.4.1.1 Groups of variables which failed to enter the discriminant analysis

Table 5.16 only presented a discriminant function consisting of four variables. This begs the question: if a set of four decision variables entered the analysis, what about the other possible combinations? Two of the five possible decision variables have two versions. For example, the implementability of an alternative was coded as being low to

Table 5.17 Discriminant Analysis Summary: Combinations of Decision Variables Failing the Normality or Equal Covariance Tests

Variable Group	Passed the Normality Test	Passed the Covariance Test
Reducing Costliness of a Coordination Error (No, Maybe, Yes) Adopt based off the Risk/Return (No, Uncertain, Yes) Implementability (Low, Moderate, High)	No	Yes
Reducing Costliness of a Coordination Error (No, Maybe, Yes) Adopt based off the Risk/Return (No, Uncertain, Yes) Implementability (Low, High)	No	No
Reducing Costliness of a Coordination Error (No, Yes) Adopt based off the Risk/Return (No, Uncertain, Yes) Implementability (Low, Moderate, High)	No	Yes
Reducing Costliness of a Coordination Error (No, Yes) Adopt based off the Risk/Return (No, Uncertain, Yes) Implementability (Low, High)	No	No
Reducing Costliness of a Coordination Error (No, Maybe, Yes) Implementability (Low, Moderate, High) Uncertainty Constraining (Not to Extremely) Expected Returns (Lower, Same, Higher)	No	Yes
Reducing Costliness of a Coordination Error (No, Maybe, Yes) Implementability (Low, Moderate, High) Riskiness of Alternative (Low, Moderate, High) Expected Returns (Lower, Same, Higher)	No	Yes
Reducing Costliness of a Coordination Error (No, Maybe, Yes) Implementability (Low, Moderate, High) Riskiness of Alternative (Low, Moderate, High) Expected Profit Constraining (Not to Extremely)	No	Yes

high, or low to moderate to high. There were a total of eight possible combinations of the five decision variables. Table 5.17 highlights those combinations of those decision variables failing the normality and/or equal variance tests.

There were a total of two combinations of these decision variables which failed to satisfy either the multivariate normality or equal covariance matrices assumptions. The remaining five combinations all failed just the normality test. Failure of these seven combinations of decision variables is one indication of how difficult it was to meet the multivariate normal and equal covariance assumptions. Satisfying the assumptions was more difficult because of the small sample size and the extensive use of categorical discriminating variables.

5.6.4.2 *Use of discriminant analysis to gain insight into the acceptability of the risk/return tradeoff*

A discriminant function was created to gain insight into how the above variables related to the adopt based off the risk/return variable (of the form acceptability of the risk/return tradeoff = f(uncertainty, how constraining the anticipated profit will be). The uncertainty and how constraining the expected profits variables could explain approximately 79 percent of the total variance as arising from difference in the adopt variable. The profit potential question appeared to explain more of the differences between adopting based off the risk/return tradeoff than the uncertainty (these results must be interpreted with caution since the normality assumption failed).

The structure matrix coefficient for profit potential was.999, while the coefficient for uncertainty was .455. A more detailed explanation of the structure matrix coefficients will be presented in a later section. However, the relative difference in size between the coefficients suggests that the profit potential variable has almost twice the explanatory power as the uncertainty variable when it comes to distinguishing between whether or not a producer will not adopt, is uncertain, or will adopt an alternative strategy given its risk/return tradeoff. Additionally, the signs of these coefficients show that as expected profit and uncertainty become more constraining, the producer is less willing to adopt the alternative based on its risk/return tradeoff.

A second discriminant function (of the form acceptability of the risk/return tradeoff = f(riskiness of alternative strategy, level of expected return of the alternative) was obtained with the adopt variable as the dependent variable and riskiness and expected returns of the alternative as the independent variables. These two independent variables accounted for approximately 84 percent of the total variation arising out of differences between not likely to adopt, unsure, and likely to adopt groups. Both independent variables, riskiness (.581) and expected returns (-.581) had the correct signs. An increase in riskiness was associated with a decrease in the likelihood of adoption, while and increase in the expected returns was associated with an increased likelihood of adoption. Both the riskiness and expected profit variables appeared to possess equal explanatory power.

5.6.4.3 Eight additional discriminant functions

Through a process of beginning with the all the individual variables (a total of 17, see Table 5.13) which passed the F test for significant differences in group means were tried in different combinations to see what combinations of variables may lead to valid discriminant functions. Groupings were required to pass the sense test in that it variables which were highly correlated such as, is profit constraining and what is the expected return for the alternative where not used in the same discriminant function. While more than 15 combinations of variables passed the equal covariance test, only eight passed both the equal covariance and normality tests.

Table 5.18 is a collection of all eight of these discriminant functions. There is a relative ordering of the functions according to the following criteria: (1) percent of total variation explained between groups, and (2) the percentage of cases correctly classified in the original and cross-validated cases. Since the patterns represented in the ten discriminant functions are similar to each other and they support the discriminant functions composed of the four decision variables, the emphasis here will be on the intuitive meaning of these functions.

The reader should immediately recognize a pattern throughout the eight functions. The relative importance of each of the discriminating variables does not changes across the eight functions. For example, the uncertainty of the alternative variable was the most highly correlated variable in seven of the eight additional discriminant functions. This is due in part to the low correlation of discriminating variables at the within group levels. Only two other variables had slightly higher absolute coefficients: adopt given the risk/return tradeoff and how constraining is the uncertainty surrounding the alternative were the two variables which seemed to possess a slightly higher explanatory power than the mismatch variable. The reader might ask why the adopt given the risk/return tradeoff was not used in more discriminant functions? All but the one combination which included the adopt question failed one or both of the normality or equal covariance tests.

Table 5.18 Discriminant Analysis Summary: Other Combinations of Variables Passing the Normality and Equal Covariance Tests

Variable Groups and Characteristics	**Structure Matrix Coefficients**[32]								
Adopt given Risk/Return Tradeoff? (No, Unsure, Yes)		-.685							
Uncertainty of the alternative? (Not to Extremely)	.698		.670	.675	.677	.569	.630	.630	.645
Profit potential constraining? (Not to Extremely)	.597		.574	.578	.580	.487	.540	.540	.552
Reducing Costliness of a Coordination Error (No, Yes)	-.560	-.558	-.537	-.542	-.544	-.484	-.506	-.506	-.517
Satisfaction with current strategy? (Not to Extremely)		.373		.362	.362	.305	.338	.338	
Implementability of Alternatives? (Low, Moderate, High)	-.330	-.329	-.317	-.320	-.321	-.269	-.298	-.298	-.305
Perceived size of strategy shift? (Small or Large)			.298						.287
Acres of rented farm land in 1997? (3 categories)		.254	.245	.247		.208	.230	.230	.235
Number of people in management? (3 categories)		.249				.203	.225	.225	.231
Mismatch w/ coordination characteristics (Low, Moderate)		.246				.201		.223	.228
Years in the business? (continuous variable)		.211				.173	.191	.191	.196
Percent of Total Variation Explained Between Groups	80	80	81	81	81	85	83	83	82
Percent of Total Variation Explained Within Groups	20	20	19	19	19	15	17	17	18
Percent of Cases Correctly Classified Original Group	92	96	96	92	92	100	96	96	100
Percent of Cases Correctly Classified Cross-validated	88	88	88	88	88	84	84	80	76

[32]Each column represents a separate discriminant function where the Low centroid is positive and the High centroid is negative

The inclusion of additional variables did not substantially increase the amount of total variance explained by difference between groups of the discriminating variables, as well as an increase in the predictive ability in original and cross-validated cases. Generally the total variance explained by differences between groups remained about the same at around 80 percent. While classification rates based on the original group stayed around 92 percent, the change in percentage of cases correctly classified with cross validated cases was no better than the decision variable function at 88 percent, and this actually declined for some discriminant functions down to 76 percent. This reduction in correctly classified cases based on cross-validated cases is likely a result of some countering effects some variables have on others. Table 5.18 highlights the tradeoffs which often take place between explaining variance and classification.

5.6.4.3.1 Interpretation of the structure matrices coefficients of the ten discriminant functions

As a result of each of the variables having the same signs, relative magnitudes, and grand centroids with the same signs across the eight functions, general interpretations can be made regarding how a shift in the discriminating variable affects the willingness to change.

As the following variables increase, the willingness to change increases: (1) increased adoption of an alternative strategy given the risk/return tradeoff, (2) the reduction of the costliness of a coordination error, and (3) the implementability of an alternative strategy increases. There were no differences in the interpretation of these functions as compared to the function based on just the four decision variables.

As the following variables increase, the willingness to change from a current strategy to an alternative becomes lower: (1) uncertainty becomes more constraining, (2) the potential for profit becomes more constraining, (3) satisfaction with the current strategy increases, (4) the perceived size of the strategy shift increases, (5) the acres of rented land increases, (6) the number of people on the management team increases, (7) the mismatch between the revealed coordination characteristics of the producer and the alternative strategy increase and (8) the longer the decision maker or his farm has been in business.

Most of these associations are intuitively appealing. It should not be surprising that increased numbers of people on the management team can lead to unwillingness of adoption given the problems in managing with more people grows geometrically. The longer a person has been in business and its association with an unwillingness makes sense because these decision makers may have tried many alternative strategies in the past, they may be nearing retirement, and a certain amount of path dependence may be prevalent. The association between increased acres of rented land and an unwillingness of change is somewhat confounding. Perhaps increased acreage of any kind represents higher levels of investment into a given strategy, thus making it harder for the decision maker to change. Another plausible explanation is that rental agreements often span many years and are relatively difficult to break. Producers maybe unwilling to try alternative strategies which may lead to higher costs associated with breaking rental agreements.

5.6.4.4 Application of a step-wise discriminant analysis

To see if classification and identification could be improved, the investigator initiated a step wise procedure where all 17 of the variables listed in Table 5.13 were entered and the computer was allowed to select the most important variables. In many situations, discriminant analysis, like multiple regression analysis, can be used as an exploratory tool. This is one of the objectives for the current research. It was not known with certainty in advance which of these variables is important for group separation and which would be mostly extraneous. Discriminant analysis employs a commonly used algorithm for variable selection called step wise selection. There are a number of criteria available for variable selection including: Wilk's lambda, unexplained variance, Mahalanobis' distance, smallest F ratio, and Rao's V (Norissus 1994: p. 21). The Wilk's lambda criterion was used in this research.

A step-wise selection procedure combines the features of forward selection and backward elimination. That is, the first variable included in the analysis has the largest acceptable value for the selection criterion. After the first variable is entered, the value of the criterion is reevaluated for all variables not in the model, and the variable entered first is reevaluated to determine whether it meets the removal criterion. If it does, it is removed from the model. The next step is to examine the variables not in the equation for entry, followed by examination of the variables in the equation for removal. Variables are removed until none remain that meet the removal criterion. Variable selection terminates when no more variables meet entry or removal criteria (Norusis 1994: p. 21).

The results of the step-wise procedure indicated uncertainty, adoption based on the risk/return tradeoff and the perceived size of the strategy shift were the most important variables in distinguishing between unwillingness and willingness to change strategy. However, when these three variables were tested for multivariate normality, they failed to pass the test. Further empirical work is needed to test these relationships.

5.6.4.5 Concluding remarks regarding the use of discriminant analysis

Only three of the possible decision nodes and their corresponding variables were found useful for discriminant analysis. These three decision nodes were: does the alternative strategy reduce the costliness of a coordination error, the acceptability of the risk/return of an alternative strategy, and the implementability of an alternative strategy. In a situation where the value of one of the independent or discriminating variables never changes it is not allowed into the model since it cannot possibly provide any explanatory power to the model.

The most problematic variable to assess of the three decision nodes which varied in the study was implementability. Implementability did stay in the final analysis and its sign was correct for its expected effect on low or high change possibilities. However, the magnitude of the structure matrix variable and the small decreases in predictive power that showed up when the variable was removed from the model suggest implementability has less explanatory than either the acceptability or the costliness of a coordination error variable.

Acceptance or non-rejection of decision node three which states if an alternative coordination strategy is implementable, then a change in vertical coordination strategy may be warranted is more tenuous given the relatively low structure matrix coefficients. Further research on implementability (just like acceptability of the risk/return tradeoff and the reduction of the costliness of a coordination error) and how it is constructed should be undertaken.

The large absolute structure matrix coefficient and correct sign on the acceptability of the risk/return tradeoff variables strongly supported decision node four of the proposed framework state as: if the risk/return tradeoff of an alternative coordination strategy is acceptable, then a change in strategy may be warranted. In fact, the results suggest a willingness to change. Decision makers are faced with risk and return decisions in most aspects of their businesses. Producers had little trouble placing a value on the risk or return of an alternative strategy.

The decision variables (in particular, costliness of a coordination error and acceptability or the risk/return tradeoff) were consistently the most influential variables in the discriminant analysis model. Equally important was that the effects of these variables were consistent with the direction of causality stated in the primary research propositions.

5.7 A Parallel Decision Step Framework

The qualitative and quantitative analysis presented in this thesis tested the was based on a decision making framework that assumed the decision process for altering a vertical coordination strategy was carried out in a step-wise manner. Costliness of a coordination error was deemed to be the catalyst which set the decision process in motion. The proposed framework illustrated a process where order proceeded to where the next step was to determine if an alternative could reduce the costliness of a coordination error followed by the programmability, implementability, and the ability of an alternative to improve the risk/return tradeoff.

Although the sequential model performed well, the qualitative and discriminant analysis results suggested not all of the decision node variables should be weighted equally. Perhaps, the ability to reduce the costliness of a coordination error and the ability of an alternative to improve the risk/return tradeoff should be given more weight than programmability or implementability? It is also possible that the decision process is more of a simultaneous process versus a step-wise process. This section presents a parallel decision step framework which seeks to incorporate more of a simultaneous decision process and one that allows the decision variables to be weighted differently.

Figure 5.3 is a graphical representation of a framework which incorporates parallel decision making steps versus sequential steps for describing the process for altering a vertical coordination strategy. The parallel framework incorporates the same catalyst for initiating the decision process as the sequential framework. Coordination errors which are costly are still the catalyst for initiating the decision process for altering a vertical coordination decision. The process to change a vertical coordination strategy begins with an uneasiness decision makers have with their current situation.

5.7.1 Change of strategy in the simultaneous decision step framework

In this research, the dependent variable was coded as a dichotomous variable: a change in vertical coordination strategy, or no change in vertical coordination strategy. In the parallel decision step framework the dependent variable will be allowed to take

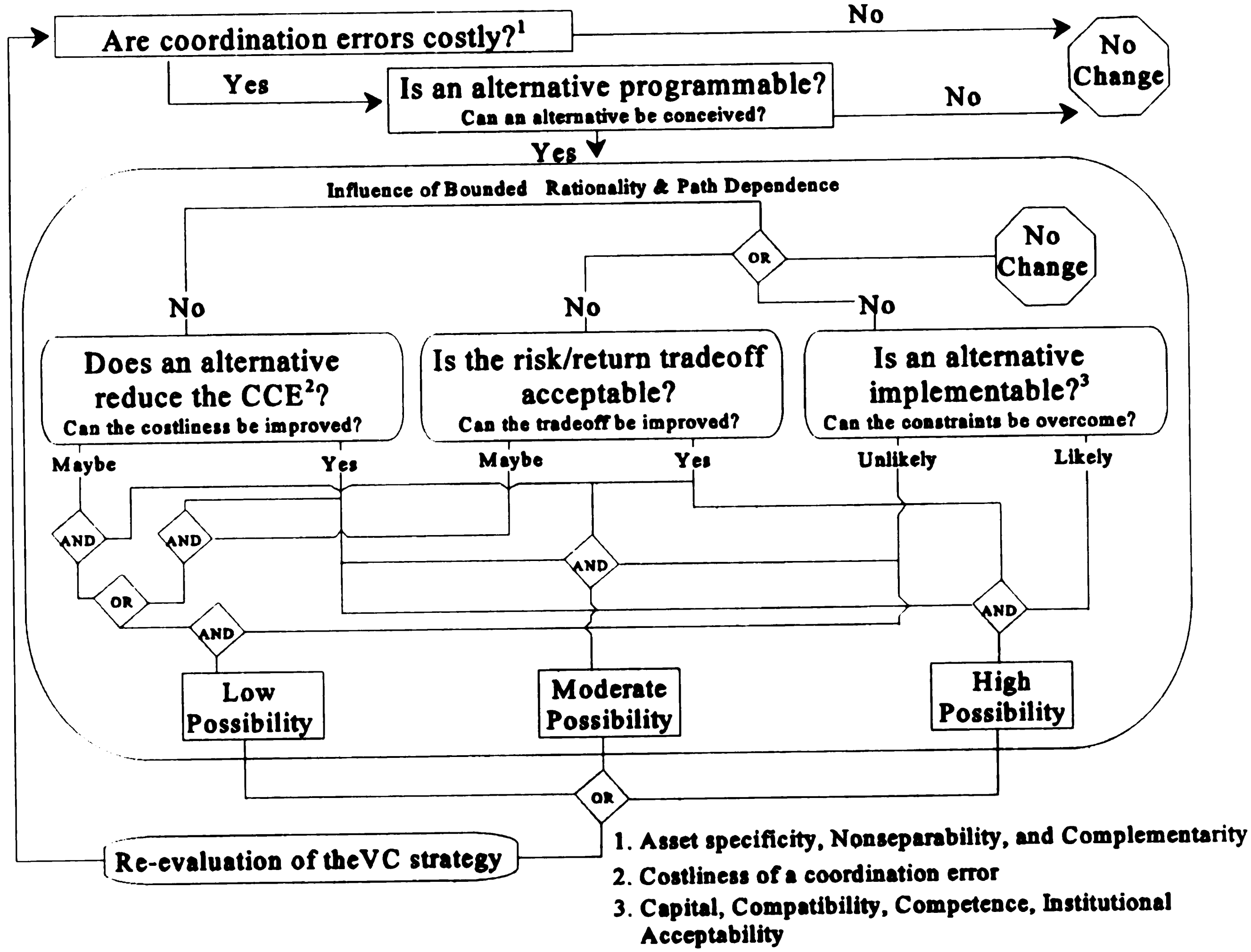


Figure 5.3 A Parallel Decision Making Step Framework

on at least four values: no possibility of change, low possibility of change, moderate possibility of change, or a high possibility of change. Allowing additional categories for the dependent variable may allow a more precise measurement of the willingness to change from a current to an alternative strategy.

5.7.2 Are coordination errors costly and does an alternative reduce the costliness of a coordination error in the parallel decision step framework

Testing if a coordination error is costly will allow the researcher to ask the respondent to reveal how comfortable they are with their current strategy, given the business environment in which they are operating. This variable could test if more respondents in other studies selected a current strategy which was the same as their theoretically optimal strategy.

If a coordination error is costly, the parallel framework continues to the programmability of the alternative. If a coordination error is not costly there is no reason for the decision maker to change from his current strategy to an alternative.

5.7.3 Programmability of an alternative in the parallel decision step framework

The parallel framework places the programmability of the alternative strategy before the parallel decision step and after the costliness of a coordination error catalyst. This placement is based on the results of this research regarding programmability and the sense test. In this research all alternatives were found programmable. If the measurement ability of this variable can be improved it can still be tested and if it is found as important as the other decision variables it can be incorporated into the parallel decision making steps. The sense test regarding programmability states that if effective management routines exist or can be conceived the decision process proceeds to the parallel decision analysis. If effective management routines do not exist or cannot be conceived, it would make no sense to the decision maker to consider reducing the costliness of fit, the acceptability of the risk/return tradeoff or the implementability of an alternative.

5.7.4 Variables in the parallel decision analysis

There are three decision variables which are considered in parallel in this framework: (1) does the alternative reduce the costliness of a coordination error?, (2) is the risk/return tradeoff of the alternative acceptable?, and (3) is the alternative implementable? The parallel decision making analysis builds on the results of this research. Each of the three decision variables are allowed to take on at least three values: no, maybe, and yes in the case of reducing the costliness of a coordination error and acceptability of the risk/return tradeoff, and no, unlikely, and likely in the case of implementability. The difference in the coding of these three variables allows the implementability variable to be scaled differently than the other decision variables. Just as in the sequential framework, a no by any of the three variables results in no change in strategy. If all three variables are yes then there will be a change in strategy. If all three variables are yes or some, then there may or may not be a change in strategy.

The innovation of the parallel decision making step framework is that it allows more weight to be placed on reducing the costliness of a coordination error and the acceptability of the risk/return tradeoff than it does on implementability (if the data supports this). For example, a yes for costliness of a coordination and a maybe for acceptability of risk/return or a maybe for costliness of a coordination error and a yes for acceptability of the risk/return in combination with an unlikely for implementability results in low possibility of change. Consider another example, a yes for costliness of a coordination error and a yes for acceptability of the risk/return tradeoff and an unlikely for implementability result in a moderate possibility of change.

The weights of the three decision variables in the parallel decision making step framework are based on the discriminant analysis results of this research. These weights could be changed if additional research suggests such a change in the decision variables. The parallel decision making step framework is a logical extension of the sequential decision making framework which warrants further study.

5.8 Concluding Remarks Regarding the Qualitative and Quantitative Analysis of the Interview Responses

A substantial amount of information was presented in this chapter regarding the qualitative and quantitative analysis of the interview responses. The demographic characteristics of the producers were highlighted to give the a feel for whom the producers were. Given the use of discriminant analysis and the high percentage of categorical variables used explaining the logic behind the coding of variables was necessary, especially the decision variables which were used to test the four research propositions.

Cross tabulations and chi-square tests were used to identify variables which were correlated with the differences between a willingness or unwillingness of producers to change a current strategy to an alternative. The variables were consistent with the subsequent findings form the case analysis and discriminant analysis.

The results of the case study and discriminant analysis of the interview responses revealed that the ability of an alternative to reduce the costliness of a coordination error was critical to the willingness and unwillingness to change strategies. Programmability was not directly assessed in this research because all producers indicated high levels of programmability whatever their willingness to change strategies. Implementability was found qualitatively and quantitatively significant, although, not to the same extent as costliness of a coordination error or acceptability of the risk/return tradeoff.. The acceptability of the risk/return tradeoff, the final decision variable, was as important as the costliness of a coordination error in the analyses.

There was strong quantitative and qualitative evidence to support research propositions one, two, and four and moderately strong quantitative and qualitative evidence to support research proposition three. Even with the relatively imprecise instruments (i.e., the decision variables), it appears the proposed framework was a reasonable model of how decision makers view the decision process for altering a vertical coordination strategy.

Finally, a parallel decision step framework was presented as a natural refinement of the sequential decision step framework based on the qualitative and quantitative results of this research.

CHAPTER 6
SUMMARY AND CONCLUSIONS

This chapter is divided into four sections. The first provides a general review of the subject matter covered within this document, focusing on the research questions addressed, data collected and analyses employed. The second section presents a summarized version of the theoretic framework of the decision process for altering a vertical coordination strategy. The third section reviews and summarizes the key qualitative and quantitative findings of the research in terms of how they confirm the proposed framework. The last section is a synthesis of the practical implications of the findings and suggestions for future research that would build upon what has been documented in the preceding five chapters, along with a refinement in the framework to allow for parallel decision making steps.

6.1 Descriptive Synopsis of the Research

In Chapter 1 the research problem was stated as: *The purpose of this research is to develop a generalizable strategic decision-making framework that can be used to prescribe appropriate vertical coordination strategies for firms in the changing U.S. agri-food system. This research seeks to further refine the theory of the firm and its predictive ability. It is hoped this revised theory of the firm will become more accessible to decision makers. Central to the success of this framework is the ability to identify* *factors which determine when it is appropriate for firm-level decision makers to change from one vertical coordination strategy to another.* These factors were postulated early in the research process to be part of a complex decision making process used consciously or unconsciously by decision makers.

The first step in identifying the relevant factors involved in the decision process for altering a vertical coordination strategy was to conduct a comprehensive literature review across the published works of three disciplinary fields: Economics, Management, and Strategy, and one applied field: Agricultural Economics. Using insights garnered from this review, the suppositions about what factors are important to choosing an alternative strategy were transformed into a comprehensive framework describing the decision process for altering a vertical coordination strategy. This framework will be discussed more fully in the following section.

With the framework as a general guide, industry and firm level data were collected by interviewing a total of 25 producers (13 seed potato producers and 12 celery producers) from the Michigan seed potato and Michigan celery industries. Additional industry information was obtained because of the researcher's experience with the Michigan and Wisconsin seed potato and Michigan celery industries, and from ten phone conversations with people associated with each of these industries. The data collection focused on better understanding the decision process managers use by asking a series of questions comparing what it would take to get the decision maker to change from their current to an alternative vertical coordination strategy.

Data analysis included a qualitative assessment of data generated by the twenty-five case studies, and a base-run discriminant analysis of the interview responses which were predominantly coded as categorical variables.

6.2 A Review of the Framework Regarding the Decision Process for Altering a Vertical Coordination Decision

The decision process for altering a vertical coordination strategy was hypothesized to be composed of a catalyst for initiating the decision process (are coordination errors costly?) and four distinct decision nodes that lead to the adoption of an alternate vertical coordination strategy. These decision nodes can be represented as four key questions: (1) does an alternative reduce the costliness of a coordination error?, (2) are there effective management routines the decision maker can rely on to aid in the adoption of the alternative strategy (is the alternative programmable?) or can effective management routines be conceived?, (3) is an alternative implementable or can the constraints associated with implementability be overcome?, and (4) is the risk/return tradeoff of the alternative acceptable or can the tradeoff be improved? (see Figure 6.1). Once an alternative vertical coordination strategy has been adopted, the framework incorporates a feedback loop which allows for reevaluation of the newly implemented vertical coordination strategy resulting in the decision process starting over again.

While many researchers have made valiant first-moves at designing frameworks to predict organizational form, reliance on any single theory eventually becomes constraining and is not able to capture the complex and often "clumsy" way the decision process works. Choice of vertical coordination strategy is best modeled as an adaptable process. The framework outlined in this research sought to extend and combined the theoretical

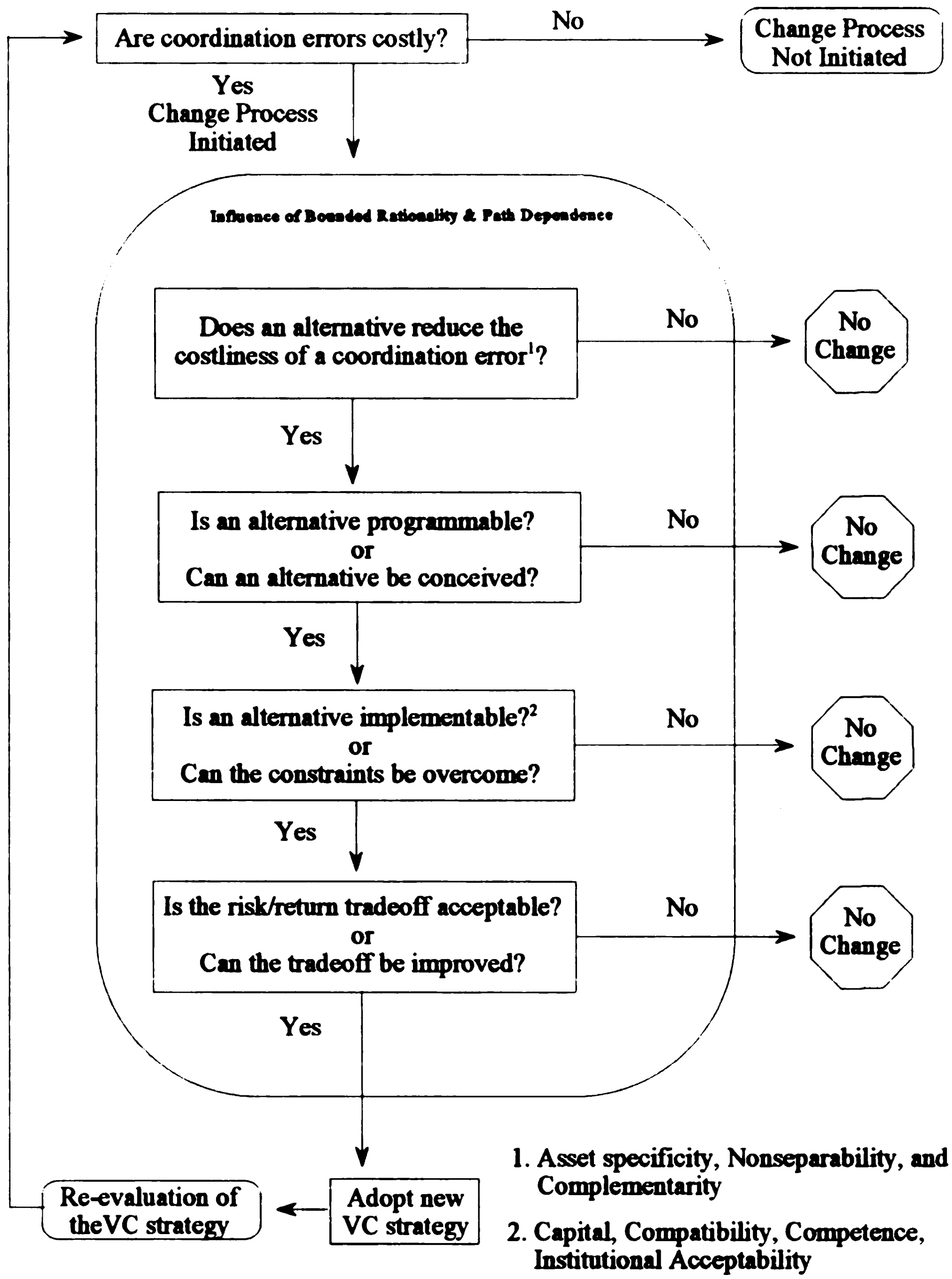


Figure 6.1 The Decision Process for Altering a Vertical Coordination Strategy Revisited

advancements made by earlier scholars in economics, business, sociology, strategic management, and organization science. Specifically, this research is an extension of: (1) transaction cost analysis (reduction of the costliness of a coordination error), (2) positivistic agency theory (reduction of the costliness of a coordination error and programmability), (3) the resource-based theory of the firm (reduction of the costliness of a coordination error), (4) trust (implementability), (5) institutional economics (implementability) and (6) neoclassical economics (the acceptability of the risk/return tradeoff). Figure 6.1 is a graphical representation of the framework as first presented in Chapter 2.

Based on a review of the literature and the proposed framework, four research propositions were identified:

RP_1: If: (1) an alternative strategy reduces the costliness of a coordination error, and (2) the alternative strategy is programmable, and (3) the alternative strategy is implementable, and (4) the risk/return tradeoff of the alternative strategy is acceptable, then a change in vertical coordination strategy will occur.

RP_2: If: (1) an alternative strategy does not reduce the costliness of a coordination error, or (2) the alternative strategy is not programmable, or (3) the alternative strategy is not implementable, or (4) the risk/return tradeoff of the alternative strategy is unacceptable, then a change in vertical coordination strategy will not occur.

RP_3: If a change in vertical coordination strategy has occurred, then: (1) an alternative strategy has reduced the costliness of a coordination error, and (2) the alternative strategy was programmable, and (3) the alternative strategy was implementable, and (4) the risk/return tradeoff of the alternative strategy was acceptable.

RP_4: If no change in vertical coordination strategy has occurred then: (1) an alternative strategy did not reduce the costliness of a coordination error, or (2) the alternative strategy was not programmable, or (3) the alternative strategy was not implementable, or (4) the risk/return tradeoff of the alternative strategy was unacceptable.

6.2.1 Construct, internal, and external validity and reliability of the research

Construct validity, as defined in this research, is how well the concepts of the proposed framework can be operationalized. That is, do the constructs/concepts of the proposed framework parallel reality? Both qualitative and statistical analysis supported a general level of construct validity in this research. Producers were asked directly if the steps described in the decision making process for altering a vertical coordination strategy made sense to them or if they would add or subtract from the set of statements. All 25 producers showed a strong agreement with the series of statements as accurately representing the decision process. Verbal cues recorded throughout the interview process also indicated strong evidence of construct validity for costliness of fit, implementability, and acceptability of the risk/return tradeoff decision variables.

The primary methods used to test for internal validity in this research were case replication based on personal observation, chi-square tests, frequency tests and discriminant analysis. Personal observations were coded and the frequencies of the relationships between the willingness to change and the four decision variables suggested a high confirmation rate of the research propositions based on the four decision variables. Propositions one, two, and four were predicted correctly 100 percent of the time, while proposition three was predicted correctly 77 percent of the time in this sample.

Discriminant analysis suggested that three of the four decision variables were quantitatively important in distinguishing between a willingness and an unwillingness to change from a current to an alternative strategy. The three variables: does the alternative strategy reduce the costliness of a coordination error, the acceptability of the risk/return tradeoff, and the implementability of the alternative strategy. Because programmability was shown to be high for all twenty-five producers, it was used in testing of those research propositions which required programmability to be yes.

External validity involves establishing the domain to which a study's findings can be generalized, to other populations, settings, or periods (Yin 1994; Ghauri, et al. 1995). External validity is a direct consequence of the research design and may be verified by using replication logic, that is, by conducting multiple case studies of other populations, settings, or periods. This research established partial external validity by applying the framework to twenty-five cases across two industries (Michigan seed potato and celery industries), at two different transaction interfaces (the production-marketing and marketing-buying interfaces).

If the framework has truly identified the important factors in the decision process for altering a vertical coordination strategy, there is reason to believe the framework may perform well under many different applications. The results of this research suggest the framework is useful at the decision maker and industry level (it may be possible to aggregate individual producer results to obtain meaningful industry results).

Different settings with varying levels of asset specificity, nonseparability, and risk/return tradeoffs should be taken into account by the framework (it appears the framework did this well in the seed potato and celery industries). Even decision makers with different preferences for risk should not be a problem since the framework accounts for risk preferences when the decision maker states the acceptability of the risk/return tradeoff. For example, in this research it would be reasonable to assume not all twenty-five producers shared the same preference for risk. What mattered to the framework was their answer to the question: "Given the combination of risk and return associated with the alternative, how likely are you to adopt? Not likely, uncertain, or likely?" However, if the framework is used to prescribe a strategic course of action to an individual or a group of decision makers, then the risk preferences of the decision makers must be known or the prescription would be inaccurate and result in non adoption.

Implementability can be applied to different settings just like the costliness of a coordination error and acceptability of the risk/return. Discriminant analysis results showed implementability to be associated with a producer's willingness or unwillingness to change to a lesser extent (although, it was still important) than costliness of a coordination error or the acceptability of the risk/return tradeoff variables. Implementability met all the conditions necessary to be included in the analysis. Qualitative analysis showed implementability to be supportive of the research propositions, similar to costliness of a coordination error and the acceptability of the risk/return tradeoff variables.

Programmability is the variable or factor which is an unknown because the producer responses did not allow testing for external validity. Further refinement of this variable and/or a research design change could help. However, the discriminant model did classify 92 percent of the cases correctly and 88 percent of the cross-validated cases correctly without any contribution from programmability in this research. Programmability was also found to support research propositions one and three in the qualitative analysis. In summary regarding external validity, this framework may perform well under varying circumstances and interfaces across agricultural industries.

A study with high reliability can be replicated by others. The emphasis here is on having independent researchers doing the same case over again, and not on replicating the results of one case by doing another case study. Reliability in this research was tested primarily through extensive meetings of the investigator and research advisors, where the logic of the research design, and in particular, the coding schemes were verified by the two research advisors.

Throughout each chapter an effort was made to outline the logic and coding scheme of the decision and other key variables used in the analysis of this research in an effort to leave a clear trail which other researchers could use to test the reliability of this research. One reliability method that would be employed in future research of this nature would be to give the raw data to an individual, besides the primary researcher and have them code the data and check these results against the results obtained by the primary researcher as a more formal test of reliability.

6.3 Key Research Findings

This section is divided into sections. The first section deals with the key findings from individual producer interviews and analysis. The second focuses on key findings from industry analysis.

6.3.1 Key findings from individual producer interviews and empirical analysis

The results of the analysis of the interview responses revealed that the ability of an alternative to reduce the costliness of a coordination and the level of acceptability of the risk/return tradeoff of the alternative strategy were critical factors in the willingness or unwillingness of a producer to change vertical coordination strategy. Programmability was not directly assessed in this research because all producers indicated high levels of programmability regardless of their willingness to change strategies. Implementability, the final decision variable was found qualitatively and quantitatively significant. However, more work needs to be done to improve the measurement ability of this variable.

Finally, there was strong quantitative and qualitative evidence to support research propositions one, two, and four, and moderately strong quantitative and qualitative evidence to support research proposition three. Ten out of ten cases confirmed the relationship between the dependent and independent variables in research proposition one. Twelve out of twelve cases confirmed research propositions two and four, and ten out of thirteen cases confirmed the direction of causality stated in research proposition three. Even with the relatively imprecise instruments (i.e., the dichotomous and trichotomous decision variables), it appears the proposed framework was a reasonable model of how decision makers view the decision process for altering a vertical coordination strategy.

6.3.1.1 Adoption: an incremental process?

Most of the producers prefer adoption to be an incremental process if they have a choice. For some producers, the adoption of an alternative may be all or nothing (e.g., celery cooperative members may have to commit all of their fresh celery if they were to partner with an outside celery shipper). This preference for an incremental adoption process is likely to be driven by many factors including: uncertainty in the marketplace, a producer's diversification strategy, buyers and others downstream are forcing changes in strategy (i.e., contracts), and the results of success with trial periods regarding alternative strategies.

Related to incremental adoption is that the average producer chose alternative strategies which were relatively close to their current strategy. This may be an indication of how people view the adoption of an alternative strategy and could be linked to the programmability issue since producers are likely to be familiar with strategic alternatives which are closer to their current strategy.

6.3.2 Key findings from industry level analysis

The effectiveness of applying the proposed framework is slightly more complicated when applied at the industry level. At the beginning of the research, the investigators believed the framework could be used to explain differences in industry performance based on differences in strategy selection. The proposed framework was highly effective at explaining the decision process for altering a vertical coordination strategy at the individual level. Individual producer observations could be aggregated to create an effective industry analysis.

Confounding the analysis at the industry level was the higher than expected number of vertical coordination strategies which were being employed at all four transaction interfaces studied. For example, in the Wisconsin and Michigan seed potato industries, spot markets, contracting, and strategic alliances were all present at the marketing-buying interface. If one accepts the notion of a theoretically optimal strategy based on asset specificity and nonseparability, then surely some of these strategies did not match up well. However, initial efforts to carry out an industry-wide analysis lead to the discovery of varying levels of asset specificity and nonseparability across industries. When these varying levels of asset specificity and nonseparability were taken into account, the framework was again useful in explaining differences.

The framework may only achieve its maximum usefulness when the specifics of an individual firm situation are known. However, application of the proposed framework at the industry level did provide some insights in the Michigan seed potato industry regarding implementability. For example, Michigan seed potato producers must overcome compatibility issues before any strategy based on formal cooperation will be possible. Such insights suggest that the proposed framework can be useful at the industry level.

6.3.2.1 Compatibility with available partners at the production-marketing interface

Compatibility between Michigan seed producers was moderate to low. Although, Michigan seed potato producers share much in terms of cultural compatibility, the day-to-day competitive interaction and differing approaches to marketing of seed often led to a refusal of seed producers to work cooperatively. This reluctance to work together limits the implementability of formal cooperation and strategic alliances between seed producers as alternative vertical coordination strategies.

Wisconsin seed potato producers face many of these same day-to-day problems between growers. However, they have managed to do a better job of putting aside their differences long enough to engage in cooperative marketing of Wisconsin seed potatoes. While both Michigan and Wisconsin have seed improvement associations, one of the primary functions of the Wisconsin Seed Potato Improvement Association is to help members work cooperatively in the marketing of Wisconsin seed potatoes. Based on the success of the Wisconsin Seed Potato Improvement Association regarding generic marketing programs, one could argue that compatibility among Wisconsin seed producers is considerably higher than the compatibility among Michigan seed producers at the production-marketing interface.

The only difference between the strategies employed by Michigan and Wisconsin seed potato producers in any of the four interfaces studied was the presence of formal cooperation in the Wisconsin seed potato industry at the production-marketing interface. Wisconsin seed producers are generally recognized for being more progressive and profitable than their Michigan counterparts. Is this one difference responsible for the substantial difference in performance between the two seed industries? Although further study is needed, given the similarities of the Michigan and Wisconsin seed potato industries, there is reason to believe that a lack of compatibility between Michigan seed producers is connected to lower performance than Wisconsin seed potato producers. Increased compatibility resulting in some form of formal cooperation would provide the Michigan seed producers with a structure to work more cooperatively on industry problems.

6.4 Areas Warranting Future Research

This final section will address two broad areas which warrant further study. First, steps are explored which can or should be taken to improve the overall measurement ability of the decision variables and other key variables of the framework. Second, suggestions are made regarding the consideration of parallel decision making steps in the framework (as opposed to the sequential steps currently used).

6.4.1 Improving the measurement ability of selected variables

Two of the four decision variables were very good predictors or indicators for a decision maker's willingness or unwillingness to change from their current vertical coordination strategy to an alternative strategy. However, these were imprecise instruments in the sense they were either dichotomous or trichotomous measures of a complex process: the decision to alter a vertical coordination strategy. Additional research should incorporate finer measurements of these important variables. For example, respondents could be asked to give their answer to the risk/return tradeoff based on a five-point scale versus a no, uncertain, or yes answer. Another refinement which could be made would be to incorporate the relative risk preferences of the decision maker into the risk/return variable.

There were a number of variables which did not measure what was expected a priori. These variables included components of each of the four decision variables and their sub-components. The variable requiring the most measurement improvement was programmability because it was not found to be low (or anything other than high) for any of the producers who were interviewed. All twenty-five producers indicated that question 14 (the question which stated the logic of the framework) made good sense and that knowing of effective management routines in the decision process for altering a vertical coordination strategy was important. Programmability may improve if additional research is able to capture more of the missing cases discussed in Chapter 5.

Allowing producers to select the alternative vertical coordination strategy did create a more realistic situation for the producer to respond to at the expense of programmability. Programmability related questions could be asked before allowing producers to select an alternative. The investigator could even suggest alternatives that are: (1) strategies close to the current strategy of the respondent, and (2) strategies which are farther from the respondent's current strategy and as a result, less likely to be programmable. In this sense, the researcher should take the lead in encouraging respondents to consider alternatives which may not be very programmable.

It may be difficult to find non-programmable alternatives in today's world with all the access to information producers have. A specific idea would be to suggest something resembling a new product, asking questions such as: "Have you thought about such and such?" In the end, programmability, while intuitively appealing may not lend itself to being operationalized.

In Chapter 5 it was suggested that implementability, although significant in discriminant analysis, was less dominate than the other decision variables. Further theoretical inquiry is needed to reexamine the variables used in the coding of implementability. Although the interview responses did not reveal any areas of implementability which were omitted, a clearer mapping of the relationship between implementation and these variables is needed. Future research should investigate the relative weights of each of the variables on implementability. For example, should all the variables be weighted equally, or should the effects of any single variable be enough to translate into low implementability? Tests of this nature could be carried out with a two or three stage model.

Giving the respondents a questionnaire to complete with specific questions geared toward implementability might allow a more direct test of the importance of implementability. For example, respondents could be asked such items as: "Suppose you have been considering joining a seed potato marketing cooperative that has the sole rights to the newest and most promising seed potato varieties out of Michigan State University. It costs $20,000 dollars to join the cooperative to cover marketing and administrative expenses. Would you join? If not, was the capital needed to join too high?"

The broad versus narrow internal coordination competence question (question four on respondent handout) was not very helpful in ascertaining the implementability of an alternative strategy. It was not written as well as it could have been. One problem was the investigator's definition of what constitutes juggling many activities at one time, was substantially different from most respondents' definition. For example, many respondents considered the management of activities such as planting, spraying, and harvesting as constituting the juggling of many activities. The intent of this question was to see if the respondents preferred engaging in activities across stages of their respective value chains (e.g., growing, distributing, and marketing of their products and services). Questions such as these can be written so that the investigator's intent comes through more clearly than in this research.

The inconclusive results of the questions concerning cultural and strategic compatibility were alluded to in Chapter 5. A series of questions may need to be used to uncover the various aspects and effects of cultural and strategic compatibility on the implementation of alternative strategies. Respondents could be asked questions relating to the types of people they like to work with, both culturally and strategically. The Myers/Briggs personality test or some similar psychological test could be incorporated into the interview process to gain a deeper understanding of the respondent's decision making processes.

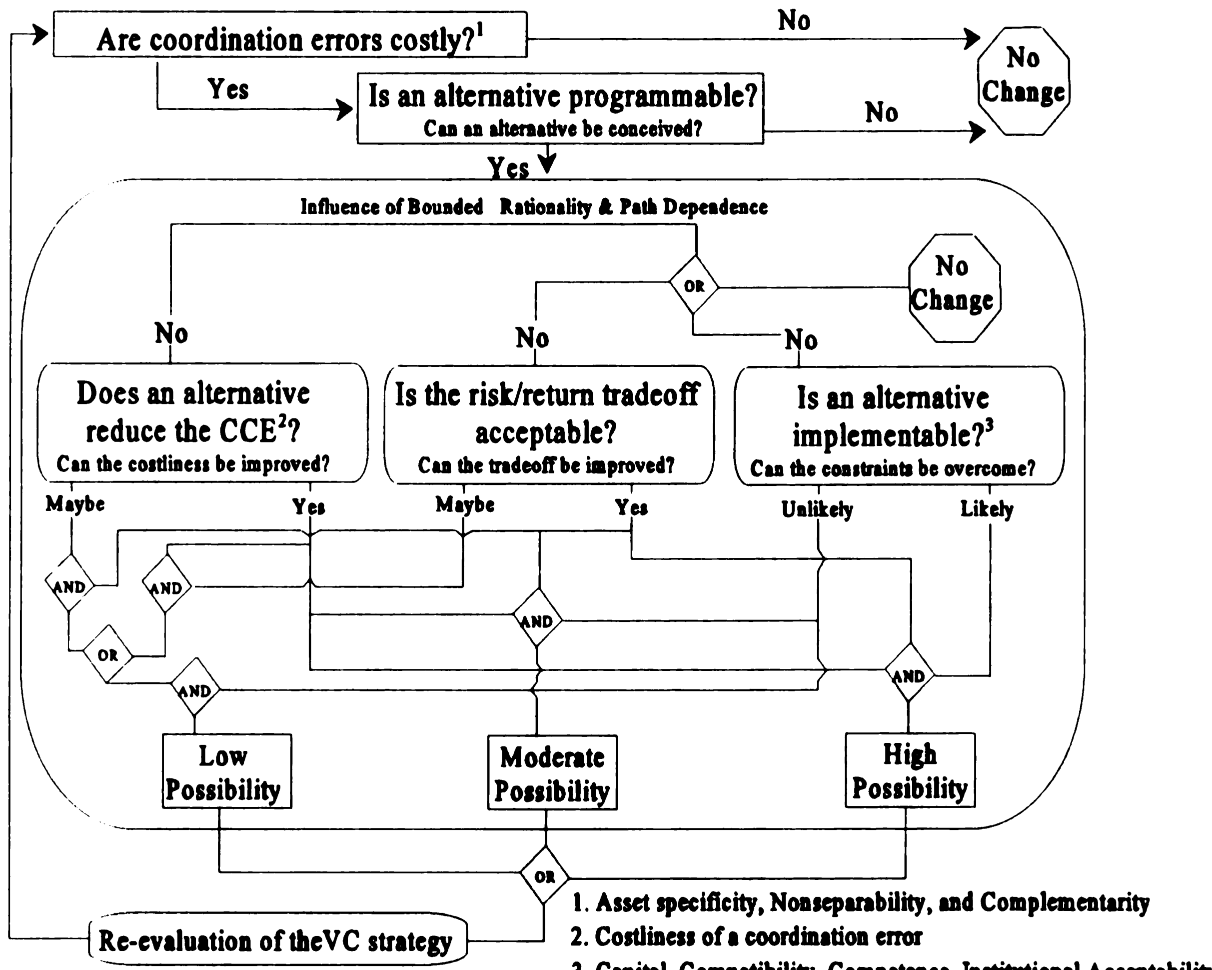
Although acceptability of the risk/return tradeoff variables proved to explain a great deal of the decision process for altering a vertical coordination strategy further refinement of this variable is possible. There is an entire body of research and associated research methodologies which could be used to better test for these effects on the vertical coordination strategy decision process. Additionally, the more testing needs to be done on the interrelatedness of risk/return with the costliness of a coordination error, programmability, and implementability.

Finally, the costliness of a coordination error variable should be tested further to see if the percentage of decision makers who are operating at their theoretically optimal strategies is not higher than the percentage revealed in this study. Additional research needs to test the reasons given in Chapter 5 for the low number of respondents who were actually employing current strategies which were the same as their theoretically identified strategies to see if these reasons are indeed valid in other research settings.

Related to all the variables is the need to do a better job of reducing the number of missing cases. The number of missing cases could be reduced by including more cases in the sample being tested and by fine tuning (sharpening if you like) the measurement abilities of the variables.

6.4.2 A parallel decision step framework

Figure 6.2 is a graphical representation of a framework which was presented in Chapter 5. This framework incorporates parallel decision making steps versus sequential steps for describing the process for altering a vertical coordination strategy.



1. Asset specificity, Nonseparability, and Complementarity
2. Costliness of a coordination error
3. Capital, Compatibility, Competence, Institutional Acceptability

Figure 6.2 A Parallel Decision Making Step Framework Revisited

The innovation of the parallel decision making step framework is that it allows more weight to be placed on reducing the costliness of a coordination error and the acceptability of the risk/return tradeoff than it does on implementability (if the data supports this). For example, a yes for costliness of a coordination and a maybe for acceptability of risk/return or a maybe for costliness of a coordination error and a yes for acceptability of the risk/return in combination with an unlikely for implementability results in low possibility of change. Consider another example, a yes for costliness of a coordination error and a yes for acceptability of the risk/return tradeoff and an unlikely for implementability result in a moderate possibility of change.

The weights of the three decision variables in the parallel decision making step framework are based on the discriminant analysis results of this research. These weights could be changed if additional research suggests such a change in the decision variables. The parallel decision making step framework is a logical extension of the sequential decision making framework which warrants further study.

This research, while exploratory in nature, and predicated on imprecise measurements of complex processes, proved to be an excellent first step at understanding and explaining the decision process for altering a vertical coordination strategy. Better understanding leads to better diagnosis and better diagnosis leads to better decisions by decision makers.

APPENDICES

APPENDIX A

APPENDIX A
INTERVIEW GUIDE QUESTIONS REGARDING THE DECISION PROCESS FOR ALTERING A VERTICAL COORDINATION STRATEGY

ASSESSING THE COSTLINESS OF FIT

1. How easy is it to use the assets in production and marketing for other purposes? (*to test for specificity including site, physical, human, brand name, dedicated assets, time, company nature, product customer nature*)? Explain________________________________

____

2. Please describe what you or your firm does well relative to other producers (*to get at their sustainable competitive advantage*).________________________________

____

3. How easy is it for others to copy or utilize the activity or skill you just described (*how vulnerable is their sustainable competitive advantage*)?__________________________

____

4. Under what situations would you consider relationships with other firms as a way of improving what you do relative to other producers? ________________________

____

5. What adjustments to your business have been caused by changing consumer needs and tastes (*measure of responsiveness*)?

____

DEALINGS WITH OTHERS AT THE MARKETING-BUYING INTERFACE

We will focus most of our discussion on your dealings with marketers or buyers.

6. Please describe your dominant business strategy:______________________________

7. Are you satisfied with your current business strategy?
Yes_____ No_____Why or why not?____________________________________

8. What alternative business strategy(s) have you considered when dealing with marketers and/or buyers?____

9. Which of the following factors would be constraining if you where to consider changing from your dominant business strategy when dealing with marketers and buyers to the alternative strategy you spoke of?

	Not Constraining	*Slightly Constraining*	*Constraining*	*Very Constraining*	*Extremely Constraining*
Uncertainty regarding how to change business strategy	❍	❍	❍	❍	❍
The profit potential of the alternative strategy	❍	❍	❍	❍	❍
Accessibility to markets of the alternative strategy	❍	❍	❍	❍	❍
The amount of capital needed to adopt the alternative strategy	❍	❍	❍	❍	❍
Accessibility of capital needed to adopt the alternative strategy	❍	❍	❍	❍	❍
The availability of available skilled labor to carry out the alternative	❍	❍	❍	❍	❍
Personal considerations (age, health)	❍	❍	❍	❍	❍
Availability of a successor	❍	❍	❍	❍	❍
Satisfaction with current strategy	❍	❍	❍	❍	❍
Current strategy based on assets with limited alternative uses	❍	❍	❍	❍	❍
The compatibility of partners	❍	❍	❍	❍	❍
The current strategy is the way you have always done business	❍	❍	❍	❍	❍
Your dominant philosophy (q 1,2,3)	❍	❍	❍	❍	❍
Your dominant management style (q 4)	❍	❍	❍	❍	❍
The role of government/institutions	❍	❍	❍	❍	❍
Other________________	❍	❍	❍	❍	❍

10. Of those factors which you said were very constraining when dealing with seed potato buyers, are there ways any of these factors could be made less constraining? Explain

Factor:__________________ ____________________________________

Factor:__________________ ____________________________________

Factor:__________________ ____________________________________

Factor:__________________ ____________________________________

11a. If you were to consider changing from your current business strategy to the alternative you spoke of, would there be examples of effective management routines that you could use to aid your firm in the adoption of this alternative business strategy when dealing with seed potato buyers? If yes, please state some examples of these management routines.____________________________________

____

____

____

11b. If no, can you think of ways you might be able to learn more about effective management routines (*i.e., university extension, consultants, etc.*)? If yes, please describe these ways.____

____

____

____

11c. If no, why are there no alternatives (*looking for path dependence, bounded rationality*)?__

____

____

____

12a. How risky (versus uncertainty, refer to response under question 9A) would it be to adopt the alternative business strategy you spoke of when dealing with seed potato buyers?
Low_____ Moderate_____ High_____ Explain________________________

____

____

12b. Do you think you could increase your returns or profits by adopting the alternative business strategy you spoke of? Yes_____ No_____
Why or why not?____

____

____

12c. When you consider the combination of risk and expected returns of your current business strategy, could this risk/return tradeoff be improved by adopting the alternative business strategy you spoke of when dealing with marketers and buyers? Yes_____ No_____
Why or why not? ____
____
____
____

12d. If you answered no to the last question, how could the risk/return tradeoff of the alternative business strategy you spoke of be improved when dealing with celery marketers and seed potato buyers?
Risk:____
____
____

Return:____
____
____

THE ADOPTION OF AN ALTERNATIVE VERTICAL COORDINATION STRATEGY

13. What other factors do you consider in your decision for altering a business strategy that we have not discussed?____
____
____

14. If you were:
    (a) uneasy or unsatisfied with your current business strategy, and

    (b) you knew of, or could conceive of management routines which could assist you in the adoption of an alternative business strategy, and

    (c) if capital, compatibility with available partners, your business philosophy, your management style, and government influences were not constraining, or could be overcome, and

    (d) the risk/return tradeoff of a alternative business strategy was equal to or greater than the risk/return tradeoff of your current business strategy would you change from your current business strategy to an alternative?

Yes_____ No_____
Why or why not?____
____
____

DEALINGS WITH OTHERS AT THE GENETICS-PRODUCTION INTERFACE

15. Tell me about your dominant business strategy when dealing with plant breeders, tissue culture labs, state seed farms or seed companies:____________________

16. Are you satisfied with this strategy?_____ What changes to you see coming when dealing with plant breeders, tissue culture labs, state seed farms, and seed companies?____________________

17. How might these changes influence your choice of business strategy when dealing with plant breeders, tissue culture labs, state seed farms, and seed companies?____

DEALINGS WITH OTHERS AT THE PRODUCTION-MARKETING OR MARKETING-BUYING INTERFACE

18. Tell me about your dominant business strategy when dealing with seed potato and celery marketers and buyers:____________________

19. Are you satisfied with this strategy?_____ What changes to you see coming when dealing with seed potato and celery marketers and buyers?____________________

20. How might these changes influence your choice of business strategy when dealing with seed potato and celery marketers and buyers?____________________

BACKGROUND INFORMATION

1. What is the total number of owned acres you farmed in 1997?___.

2. What is the total number of rented acres you farmed in 1997?___.

3. What was the total number of acres devoted to seed potato or celery production in 1997?________, in 1995?________

5. How many years have you been raising seed potatoes or celery? ____.

6. Please describe the business organization on your farm unit in 1997. If your are involved in more than one operation, choose the farm unit that provides you with the largest profit. (*Check only **one***)

❍	individual owner	❍	corporation - family
❍	family partnership	❍	corporation - non-family
❍	partnership with non-family member	❍	investor-owned (absentee)
❍	limited partnership	❍	limited liability corporation
❍	other____________________		

7. What is the age of primary decision maker in your operation?

❍	< 25	❍	25 - 35	❍	36 - 45
❍	46 - 55	❍	56 - 65	❍	> 65

8. What is the age of potential successors regarding your operation? (*Check **all** that apply*)

❍	< 25	❍	25 - 35	❍	36 - 45	❍	46 - 55
❍	56 - 65	❍	> 65	❍	does not apply		

9. How many people are on the management team including wives, if appropriate?_____

10. Please indicate the **highest** level of formal education acquired by the primary decision maker

❍	some highschool	❍	completed highschool
❍	some undergraduate	❍	completed undergraduate studies
❍	some graduate school	❍	completed graduate studies

11. Do you expect yourself or your farm to remain in seed potato production:

		Yes	*No*	*Don't Know*
A.	this year, (1998)?	❍	❍	❍
B.	in five years (2003)?	❍	❍	❍
C.	in ten years (2008)?	❍	❍	❍
D.	in twenty years (2018)?	❍	❍	❍

APPENDIX B

APPENDIX B
1998 MICHIGAN SEED POTATO AND CELERY PRODUCER SURVEY

INSTRUCTIONS

We are discovering producers are finding new ways to market their crops in the food system. We would like some insight into how you would consider various opportunities to conduct business with potential partners.

CHARACTERIZATION OF HOW YOU DEAL WITH OTHERS IN THE FOOD SYSTEM

Consider the following sets of business philosophies described below. Please weight your preference for each set of two philosophies. A score of 0 implies the statement does not describe your philosophy at all, while a score of 5 implies the statement describes your philosophy very well. Assign a total of 5 points (no fractions) between each of the sets.

1. Business philosophy set one:

   _____ I commonly seek a lot of information about various market prices, drive a hard bargain, and enjoy the challenge of on-the-spot dickering.

   _____ I like to deal with people on the basis of long-term agreements which may be built on contracts or require the formation of a new business entity. At the core of these relationships are trust, and mutually shared interests. I enjoy balancing the needs of my operation against the demands of these various business arrangements.

   Total = 5

2. Business philosophy set two:

   _____ I like to deal with people on the basis of long-term agreements which may be built on contracts or require the formation of a new business entity. At the core of these relationships are trust, and mutually shared interests. I enjoy balancing the needs of my operation against the demands of these various business arrangements.

   _____ I prefer to have control over the inputs, production, distribution, and marketing of multiple segments of the seed potato production-marketing chain. I prefer to manage and oversee multiple business arrangements.

   Total = 5

3. Business philosophy set three:

_____ I commonly seek a lot of information about various market prices, drive a hard bargain, and enjoy the challenge of on-the-spot dickering.

_____ I prefer to have control over the inputs, production, distribution, and marketing of multiple segments of the seed potato production-marketing chain. I prefer to manage and oversee multiple business arrangements.

Total = 5

4. Please classify your preferred or most dominant management style. Weight how well each of the following statements describe your management style. A score of 0 implies the statement does not describe your management style at all, while a score of 5 implies the statement describes your management style very well. Assign a total of 5 points (no fractions) between the two management styles described below.

_____ I enjoy juggling many activities at one time. I often get bored unless I can find new challenges. I consider myself to be a "jack of all trades."

_____ I like to concentrate on a limited number of activities. I would rather do a few things well and see them through to completion, than to start a lot of new activities.

Total = 5

5. Please indicate your agreement or disagreement with the following statements regarding how you deal with others regarding the marketing of your crops? (*For each tradeoff, check the appropriate circle*)

		Strongly Agree	***Agree***	***Undecided***	***Disagree***	***Strongly Disagree***
A.	I consider long-term (>2 yrs) relationships more critical than short-term (≤2 yrs) relationships to the success of my business	O	O	O	O	O
B.	I prefer working with one competent shipper/broker versus working with multiple shipper/brokers	O	O	O	O	O
C.	I prefer to determine my own shipping schedule versus a shipping based on multiple growers	O	O	O	O	O
D.	I prefer the ability to joint market with other growers versus the ability to find my own markets	O	O	O	O	O
E.	I prefer to rely solely on myself versus relying, in part, on others	O	O	O	O	O
F.	I prefer to share limited information with buyers versus sharing significant amounts of information with buyers	O	O	O	O	O

I would now like to ask you a number of open-ended questions regarding the process you use to make business strategy decisions.

APPENDIX C

APPENDIX C
SAMPLE LETTER SENT TO PRODUCERS ASKING FOR AN INTERVIEW

"Name"
"Address line # 1"

Dear *"Name"*:

Michigan seed potato producers recognize that the U.S. food system is constantly evolving due in part to: (1) the increasing demands and changing needs of consumers, (2) the adoption of new growing and processing technologies, and (3) the increasing sophistication of producers in competing areas. Today, Michigan seed potato decision makers have many options regarding how to market their products and they need criteria by which to make these choices, if they are to meet consumers' needs and to increase their long-term profitability.

The MSU Experiment Station is funding research to better understand what motivates decision makers to seek out alternative vertical coordination strategies, while others are satisfied with their current strategy. The MSU Department of Agricultural Economics will conduct this research. The goal of this research is to develop a decision making framework that can be used to prescribe appropriate vertical coordination strategies in the changing U.S. food system.

My name is Allen Wysocki. I'm a Ph.D. student in Agricultural Economics at Michigan State University. I will be conducting this research under the direction of H. Christopher Peterson, Associate Professor, Department of Agricultural Economics.

As a result of consultation with the Michigan seed potato association steering committee, it was determined the best way to collect data for this research would be through face-to-face and phone interviews. You may be assured of complete confidentiality. Your name or your firm's name will not be used in any reports. The information obtained from you will be presented as a combination of information gathered from you and other people associated with the seed potato industry.

Knowing your time is valuable, I will call you to arrange a face-to-face or phone interview with you. You indicate your voluntary agreement to participate in this research project if at the time I call, you agree to arrange for a face-to-face or phone interview. During the interview, you are free to refuse answering any questions or to decline form participating in the study, without penalty. Interviews will last approximately one hour. Your privacy will be guaranteed.

If you have any questions, please call me at (517) 882-3333 or your may contact Dr. H. Christopher Peterson at (517) 355-1813.

Sincerely,

Allen Wysocki

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