Strategic choice along the vertical coordination continuum

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Abstract

Starting from the generalized notion of a vertical coordination continuum introduced by Williamson and others, the article more specifically defines the nature of the continuum, especially the array of hybrid strategies. The continuum as presented includes five distinct groups of strategy– spot markets, specification contracts, relation-based alliances, equity-based alliances, and vertical integration. The article then presents a decision making framework that can be used by firms to determine which place on the continuum makes the most sense for a particular transaction. The framework suggests that five assessments are critical to adopting a specific change in coordination strategy: (1) Is the current strategy too costly?; (2) Would an alternative strategy reduce the cost?; (3) Is an alternative programmable?; (4) Is an alternative implementable?; (5) Is the risk/return tradeoff acceptable? If the answers to all five assessments are ''yes,'' then a change in strategy would be expected to occur. © 2001 Elsevier Science Inc. All rights reserved.

1. Introduction

Fundamental changes are continuing, if not accelerating, in the agri-food system. Changes that are altering traditional marketing relationships. Parts of the food system have become tightly integrated, such as the poultry and 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 appears to be largely focused on either (1) developing a better understanding of the characteristics and motivations of an individual mode of coordination (Sporleder, 1992; Frank & Henderson, 1992), or (2) understanding the broad differences between external (market) and internal

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(contract/ownership) approaches to vertical coordination (Barry, 1995; Martin et al., 1993; Barkema, 1994; Boehlje & Schrader, 1994). Each of these efforts have been necessary and valuable, but there remains coordination dimensions that need to be explored and analyzed. In particular, given the increasing variety of vertical coordination strategies available to agri-food firms, how does a particular firm decide which strategy to use in which vertical transaction?

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. It can also be observed that any one firm may use a number of different strategies depending upon the nature of the transaction or transactional relationship in a vertical supply chain. On the one hand, if each of these strategies is distinct and each transaction is distinct, the firm-level decision process may become onerous if no taxonomy exists to interrelate these strategies and transactions. In effect, a firm's decision makers would either engage in a nearly endless process of assessing coordination strategy transaction by transaction, option by option, or settle too quickly on a rule-of-thumb or habitual choice that may not be effective for a given transaction. On the other hand, if the strategies are interrelated and form a true continuum of transaction coordination options, then understanding the continuum and its characteristics would facilitate an improved decision process. A given firm could assess its current and/or desired place on the continuum with respect to a particular transaction and then select an appropriately limited number of coordination strategies for further analysis and choice.

The purpose of this article is to analyze in greater detail than the existing literature a vertical coordination continuum that may provide a limited number of factors a firm should consider in its choice of vertical coordination strategy for a particular transaction. The article proceeds as follows: definition of the continuum, development of criteria for strategy selection, and presentation of conclusions and unresolved issues.

2. Defining the continuum

Vertical coordination can be defined as "the alignment of direction and control across segments of a production/marketing system (King, 1992)". The factors that are aligned and controlled are price, quantity, quality, and terms of exchange (Sporleder, 1992). From a theoretical perspective, the options for achieving vertical coordination have been conceptualized by prior authors as a continuum running from open markets to complete vertical integration (multiple market stages under single ownership). Williamson has established this sense of a continuum generally, while Sporleder (1992), Barkema (1994), Henderson (1994), Martin et al. (1993), and Galizzi and Luciano (1997) and others have presented this idea in relation to agri-food markets.

The two ends of the continuum have been analyzed in many ways by many authors historically. The classic make vs. buy decision and the specifics of vertical integration have long been the subject of research. For example, Porter addresses these issues in both his 1980 and 1985 books on strategy. He even discusses coalitions as a middle strategy although

he never discusses the collection of vertical strategies as a continuum (Porter, 1980, 1985). A variety of hybrid coordination strategies between spot markets and vertical integration have been identified, ranging from formal mechanisms, such as, contracts and equity arrangements (Joskow, 1987; Osborn & Baughn, 1990), to more informal strategies, such as, information sharing and joint planning (Noordewier, John, & Nevin, 1990; Palay, 1984). The middle has also been defined as networks (Thorelli, 1986) or hybrid governance structures (Williamson, 1975; Powell, 1987; Borys & Jemison, 1989). There has even been considerable research regarding individual strategies within the continuum. For example, Spekman, Isabella, MacAvoy, and Forbes (1996) conducted an in-depth analysis of a number of international strategic alliances in order to better understand the processes of alliance formation and management.

Although the idea of a continuum is intuitively appealing, much more needs to be known about the relationships that exist between various coordination strategies and how they truly form a continuum, most especially in regard to the multitude of potential hybrid strategies. This research seeks to understand the uniqueness and inter-connectedness between individual strategies and the continuum of vertical coordination strategies.

Fig. 1 presents the continuum hypothesized for this discussion. Five major categories of vertical coordination strategy are suggested running from spot markets to vertical integration. At the ends of the continuum, the characteristics of "invisible-hand"
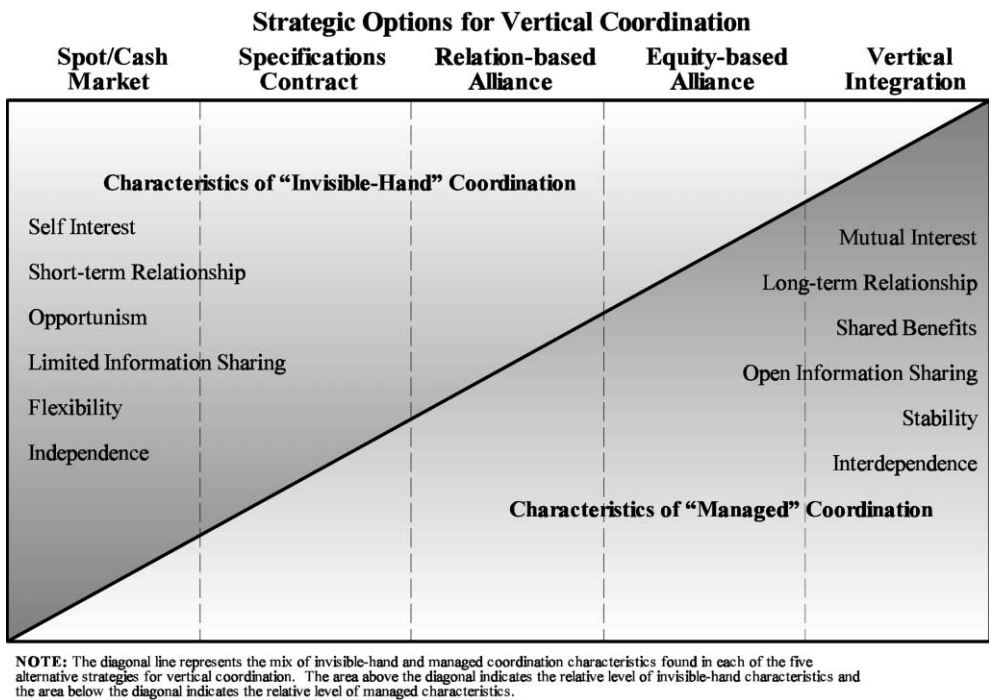

Strategic Options for Vertical Coordination

| Spot/Cash Market | Specifications Contract | Relation-based Alliance | Equity-based Alliance | Vertical Integration |

Characteristics of "Invisible-Hand" Coordination

Self Interest

Short-term Relationship

Opportunism

Limited Information Sharing

Flexibility

Independence

Mutual Interest

Long-term Relationship

Shared Benefits

Open Information Sharing

Stability

Interdependence

Characteristics of "Managed" Coordination

NOTE: The diagonal line represents the mix of invisible-hand and managed coordination characteristics found in each of the five alternative strategies for vertical coordination. The area above the diagonal indicates the relative level of invisible-hand characteristics and the area below the diagonal indicates the relative level of managed characteristics.

Fig. 1. The vertical coordination continuum.

coordination and "managed" coordination are, respectively listed. True to Adam Smith, invisible-hand coordination allows individual economic actors to follow their self-interest and pursue exchange relationships that are short-term, opportunistic, 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 Fig. 1 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 coordination being dominated by managed characteristics.

An obvious first question in defining the continuum is why a continuum of coordination strategies is needed at all? Williamson (1973) has clearly shown why. In a world of bounded rationality and opportunism, the neoclassical result that coordination automatically arises from the operation of a market system does not hold. Coordination errors can exist either because (1) they are intentionally created through the opportunism and hold-up activities of those with market power, or (2) they are unintentionally created by the bounded rationality of economic actors who produce too much or too little given the uncertainties of the marketplace. Williamson argues that hierarchy (managed coordination) can be substituted for markets (invisible-hand coordination) and economic efficiency will thereby be increased. In other words, the form of governance structure does matter.

But why so many potential alternatives for managing coordination? Showing that the two end strategies as well as the middle strategies form a natural continuum requires a primary focus on how the various strategies achieve coordination across the continuum. The argument advanced here is that the latent variable that creates the continuum is the intensity of control that the alternative strategies employ to assure that proper coordination occurs, i.e., coordination with minimum potential for error. Strategies toward the left side of the continuum have low intensities of control while the strategies toward the right side have high intensities of control. Moreover, the very nature of control fundamentally shifts as one moves from left to right on the continuum. The relevance of control to the continuum is not new. The many authors already cited have in one way or another used the notion of control in regard to the continuum. The contribution here is a more careful elaboration on the shifting means of control across the continuum.

With spot markets, the intensity of coordination control is low. The invisible-hand of the market determines price and broadly acceptable performance standards. The only control that parties on each side of a transaction can exercise is to engage in price discovery and make either a yes or no decision to enter into the transaction. In this sense, the opportunity to exercise control occurs almost entirely *ex ante* to the transaction. The only *ex post* control decision is whether or not to repeat the transaction with the same party if such repetition is needed in the future. In cases of less than pure competition, e.g., monopoly, one actor can have a major influence over the establishment of the coordinating conditions. To actors with this market power, it would seem that they have coordination control to specify some of the terms of exchange. However, in spot markets, the weaker actor retains the right to walk away from the exchange, and the availability of substitute products puts another type of external limit on the intensity of control that can be exercised.

The next step, moving to the right along the continuum, is suggested to be specification contracting, the legally enforceable establishment of specific and detailed conditions of exchange. With specification contracts, the intensity of control markedly increases from that related to spot markets (although it is still moderately low vs. other alternatives yet to be discussed). The parties to a transaction can exercise coordination control through the *ex ante* negotiation of contract specifications and the mutually agreed upon incentives for meeting the specifications. The parties must invest time and due diligence beyond mere price discovery and a yes/no decision to transact. *Ex post*, the parties exercise control through proper monitoring of contract execution and related decisions to renew or renegotiate the contract, or seek third party enforcement if one of the parties fails to perform. In this sense, *ex post* control is more intense than under spot markets. However, the success of specifications contracting is still largely dependent upon the *ex ante* control process. The contract specifications and incentives once established become the immutable standards upon which all *ex post* control activities depend. The most extreme *ex post* control even lies beyond the transacting parties themselves in that the ultimate enforcement of performance is delegated to a third, external party represented by the legal system.

A relation-based 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. For a strategic alliance to be relation-based, Martin et al. (1993) maintains that it must exhibit the following three characteristics: mutuality in objective identification, mutuality in controlling decision making processes, as well as mutuality in sharing risks and benefits. Following this definition, coordination in a relation-based alliance arises from mutual control. The analogy of a marriage is appropriate when discussing relation-based 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. Coordination control arises from mutual interests.

The intensity of control needed to align and maintain mutual interests involves processes that are more complex than those for either spot markets or specifications contracts. It is in this sense that control intensity reaches another, higher level. The focus of control becomes the relationship between the parties with the immediate transaction being only one element of the relationship. *Ex ante*, the control process involves building the relationship to help assure that mutual interests are in fact present. Arriving at mutual objectives and setting informal parameters for judging the on-going nature of the relationship and its effectiveness in transacting also become key control activities. *Ex post*, monitoring relationship and transaction performance is essential, and when coordination results are less than expected, mutual resolution of concerns or a mutual decision to dissolve the relationship must occur. In the *ex post* control activities, the informality of the *ex ante* activities implies that no third party judge can be of much assistance and only internal resources of the parties can be brought to bare on coordination error resolution. If successful coordination is to be achieved, parties in a relation-based alliance must invest significant time and commitment to both the *ex ante* and *ex post* control processes. In the final analysis, it is the relationship that determines control and not any specific transaction *per se*.

With relation-based alliances, the continuum crosses a significant dividing line between coordination strategies that rely primarily on *ex ante* control (spot markets and contracts)

and strategies that rely primarily on *ex post* control (equity-based alliances and vertical integration). For example, Quaker Oats Company and HEB Grocery Company (a regional wholesale/retail grocer headquartered in San Antonio, Texas) have formed a strategic alliance based on mutually agreed upon product performance goals. After a period of lengthy and high level discussions, Quaker Oats agreed to share production and gross margin figures with HEB Grocery. HEB agreed to share specific sales and profit figures for all products in selected categories (many of which Quaker Oats could supply). The results were dramatic: (1) sales and profits of Quaker Oats products to HEB Grocery increased (Quaker Oats was able to consistently send full trucks instead of part load trucks increasing efficiency), and (2) HEB was able to lower the cost of Quaker Oats products, and increase profits (most of these savings were passed on to their consumers allowing HEB to strengthen its market position). While these performance goals were written, they were not legally binding in a contractual sense, nor was there any substantial equity commitment on the part of either partner. The underlying force that holds the relation-based alliance together is the actual achievement of mutual benefits that demands close working relationships. If the benefits do not materialize, the alliance is likely to dissolve quickly because of the ease with which both parties could walk away.

Before discussing the final two categories of vertical coordination strategies, an 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) had an exclusive supplier contract as part of its alliance with Thorn Apple Valley,[1] a meat processor. But this contract was only one part of the alliance's foundation. The two organizations hoped to develop joint marketing strategies that would improve the ability of both organizations to prosper in the changing meat industry. If relation-based alliances are 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 strategy for coordination. In the MLE–Thorn Apple Valley example, the operative strategy was not the legal agreement itself, but rather mutual control with a fallback reliance on a contract as a minimum standard for the exchange relationship.

The fourth position along the continuum, equity-based alliance, has been the one least explicitly defined by prior authors. It is designed to include a seemingly odd mixture of organizational forms that include joint ventures, partial ownership relationships, clans, and other organizational forms that involve some level of shared equity capital between the actors in an exchange relationship. The distinguishing feature between this portion of the continuum and relation-based alliances is the presence of a formal organization that has an identity distinct from the exchange actors and that is designed to be their joint agent in the conduct of the coordination transaction. For the first time along the continuum, the center of control is accomplished by a formal organizational structure. Policies and procedures can be formally put in place for the conduct of exchange between the parties. An equity commitment makes the defining of decision rights and responsibilities more clear cut than in the case of a relation-based 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 strategy is that, although control can now be accomplished organizationally, the control is decentralized among the ownership parties and the ownership parties still maintain a separate identity that allows them to walk away from the exchange if they so desire. The ability to walk away, however, has been dramatically reduced by the presence of substantial investment in the new independent identity. It is the establishment and maintenance of this independent organization that raises the intensity of control beyond the level established under relation-based alliances.

The focus of control with an equity-based alliance is a function of defining the property rights of stakeholders in the independent entity created by the parties. *Ex ante*, the control process consists of negotiating the formation of the formal decentralized organization that will govern the *ex post* resolution of any coordination concerns. Control of the transaction is delegated to the new, limited organization with the ability of the ownership parties to monitor results and adjust policies and procedures *ex post*. In this strategy, the real control power is exercised through the *ex post* processes and not the *ex ante* ones. Take the traditional marketing cooperative as a example. Producers come together to form the new cooperative entity without giving up their own separate business identities. The *ex ante* activities focus on legal formation of the cooperative (including all its relevant governance structures), a business plan, and initial financing which establishes the equity contribution of the individual members. The producers then exercise *ex post* control through a board of directors that sets policies and procedures for the execution of all transactions.

The final portion of the continuum is vertical integration, i.e., the creation of one organization that has control over the coordination transaction. Extending the reasoning from the prior portions of the continuum, vertical integration results in the two parties to a transaction becoming one party and thus true or complete hierarchy is achieved. This can result from merger of the two parties, acquisition of one party by the other, or one party internally committing resources to replace the market function of the other party. In any event, coordination control is exercised within the policies and procedures of a single organization. For the first time in the discussion of continuum strategies, control can be conceived of as centralized There are no separate parties to the transaction that retain independent decision rights. As with an equity-based alliance, the focus of control is defining the property rights of key stakeholders, but now the rights are in one surviving entity rather that in a limited separate entity. The intensity of *ex ante* and *ex post* control processes are thus increased even further in that the scope of control decisions and the difficulty of re-separating the parties makes the control tasks even more complex. *Ex ante*, the control process involves negotiating the formal centralized *ex post* governance structure. *Ex post*, control results from effective execution of governance policies and procedures for the centralized organization.

Note that the above definition of vertical integration relies on one centralized control organization rather than on the more traditional notion of single ownership. This is a subtle but critical change in definition. For example, although a corporation operating at multiple levels in a production/marketing chain may have single 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 series of equity-based alliances and not vertical integration. Vertical integration in this version of the

continuum is a strategy 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 ownership no longer assures singularity of organization as the above example of a decentralized firm suggests. Vertical integration requires a centralized decision making structure that tightly controls the operations of its diverse business units. Just as single ownership may not result in vertical integration, multiple ownership does not rule out vertical integration by this definition. For example, does a large poultry processor operate on the specification contract portion of the continuum, or does it exercise sufficient centralized control that it operates a truly vertically integrated system with producers maintaining separate ownership identity in name only? The latter is probably closer the truth, and thus this large poultry processor can be said to be vertically integrated even in the absence of single ownership. This situation is referred to in common parlance today as integration even though it does not meet the traditional definition of vertical integration.

The above discussion has attempted to establish that the proposed continuum is a continuum in much more than name only and to elaborate in more detail than past literature on the shifting control processes across the continuum, especially across the middle strategies. The coordination strategies move from low levels of coordination control intensity (spot markets) to high levels (vertical integration) while passing through several transitional levels of ever increasing intensity (specifications contracts, relation-based alliances, and equity-based alliances). The nature of control also transitions from being predominately exercised *ex ante* to predominately *ex post*. Although singularity of ownership is correlated with this transformation, it is not (as historically argued) synonymous with it. Table 1 provides a summary look at how control intensity changes across the continuum.

3. The coordination strategy decision

Having defined the nature of the coordination continuum, the next logical question is where should a particular firm locate itself along the continuum for each of its vertical transactions. Potentially, a firm must make this strategic decision for every vertical (forward and backward) exchange relationship that it must execute in the process of doing business. In practice, only major recurring transactions are likely to receive the full analytic treatment suggested here. Nonetheless, finding effective and efficient means to make these decisions would seem of obvious importance. This is especially true for agribusiness firms that have had a limited set of vertical coordination strategies to choice from in the past.

Within the agricultural economics literature, Barkema (1994), Martin et al. (1993) and Boehlje and Schrader (1994) have all made initial attempts to define criteria that help a firm decide between open markets and generic managed coordination, but these attempts were only partially designed to address the finer decisions between the various forms of managed coordination. From the management strategy literature, Mahoney (1992) has provided an extensive theoretical derivation of eight coordination strategies based on three conditions that he argues are sufficient to specify coordination mechanisms. He draws upon agency,

Table 1
Control intensity across the vertical coordination continuum

	Spot market	Specification contract	Relation-based alliance	Equity-based alliance	Vertical integration
Intensity of control	Low (*ex ante* dominate)	Moderately low (*ex ante* dominate)	Moderate (mixed *ex ante* & *ex post*)	Moderately high (*ex post* dominate)	High (*ex post* dominate)
Focus of control	Immediate transaction	Contract terms	Relationship	Property rights of stakeholders in limited joint entity	Property rights of stakeholders in full entity
Ex ante control process	Price discovery	Setting specifications	Relationship building	Negotiating the formal decentralized *ex post* governance structure	Negotiating the formal centralized *ex post* governance structure
	Yes/no decision to transact	Setting incentives	Setting informal parameters		
Ex post control process	Yes/no decision to repeat the transaction	Decision to renew/ renegotiate contract, or seek third party enforcement	Mutual resolution or dissolution	Execution of governance policies and procedures in the limited entity	Execution of governance policies and procedures in the full entity

organizational economics, property rights, and dynamic resource-based theory to justify his three conditions. These conditions are asset specificity, task non-separability, and task programmability. His eight strategies readily align themselves across the continuum defined in the last section.

However, the sufficiency of Mahoney's conditions are open to question. For example, Martin et al. (1993) presented a related scheme of strategies created by using risk, trust, and competence as the criteria. A number of 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 subelements of programmability and non-separability. Even so, Martin et al. (1993) provide a sound basis for questioning the sufficiency of Mahoney's conditions.

Given the evolving nature of vertical coordination strategies, the authors of this article have reason to advance an alternative framework that may serve useful to decision making along the continuum. This framework arises from focusing more specifically on the analysis that the manager of a firm might make as part of any decision about vertical coordination strategy with regard to a particular transactional relationship. Fig. 2 presents the proposed framework.

Intuitively, how would operating managers approach the coordination strategy decision if they understood the varying level of control intensities suggested by the continuum? The framework of Fig. 2 suggests that such managers would ask themselves five interrelated questions. First is a process initiation question: Is the cost of the current coordination strategy too high in relation to a particular transaction or transactional relationship? All but newly established firms are already engaged in vertical transactions, and all thus have current coordination strategies, transaction by transaction, whether intended or not. The process of selecting a coordination strategy is then for most firms a process of considering alternatives to what is already being done rather than starting with a blank slate.

A current strategy may be too costly for one of two reasons. First, it allows costly coordination errors to occur. For example, it regularly exposes the firm to the opportunism of trading partners or it results in chronic over or under production vs. demand. Second, the method of coordination control creates more operating cost than the cost reduction in coordination errors it is designed to control. Having constructed a continuum over which the intensity of control escalates, it is easy to reason that the cost of control escalates along with intensity. Therefore, a strategy may become too costly to operate as the transaction environment changes. For example, vertical integration of input components may be critical to avoiding coordination errors early in the life cycle of a product when suppliers of quality inputs may be unavailable. As a product matures however, input suppliers become knowledgeable and skillful at providing needed inputs under a contracting arrangement that makes the investment and internal control processes of vertical integration too costly to sustain for input supply. If the cost of a current strategy is deemed to be too high for either of the above reasons, managers would be expected to initiate a process of strategy change for the transaction in question.

Once the decision process is thus initiated, the second critical question is: Would an alternative strategy reduce the costliness of coordination? The answer to this question depends upon whether or not another strategy would better match the intensity (and cost) of
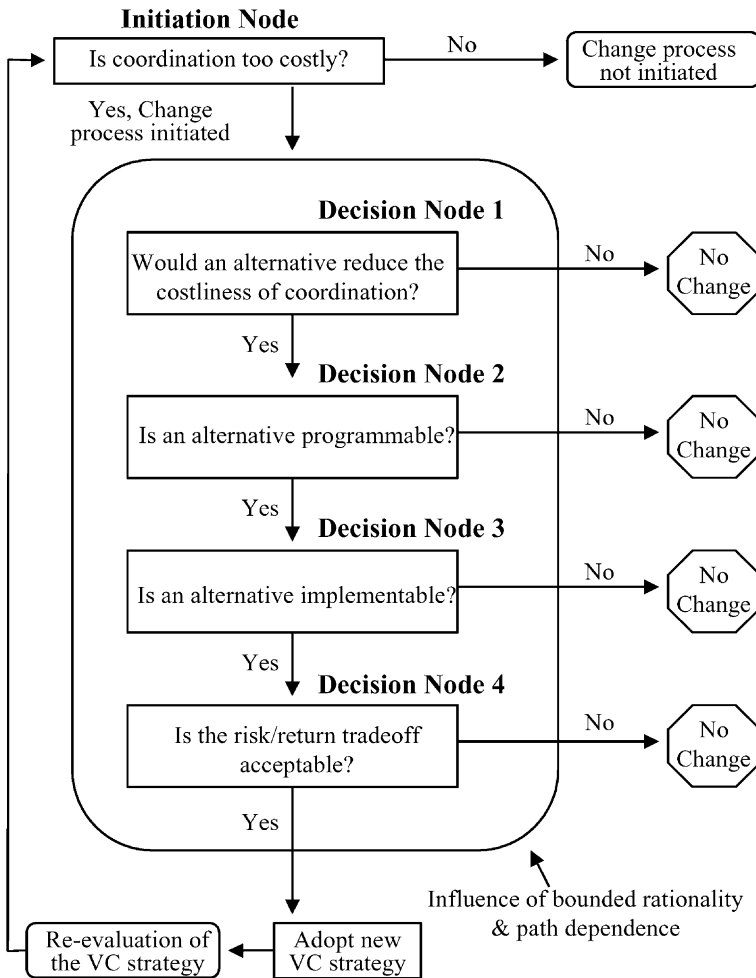
Initiation Node

Is coordination too costly? — No → Change process not initiated

Yes, Change process initiated

Decision Node 1

Would an alternative reduce the costliness of coordination? — No → No Change

Yes

Decision Node 2

Is an alternative programmable? — No → No Change

Yes

Decision Node 3

Is an alternative implementable? — No → No Change

Yes

Decision Node 4

Is the risk/return tradeoff acceptable? — No → No Change

Yes

Influence of bounded rationality & path dependence

Re-evaluation of the VC strategy ← Adopt new VC strategy

Fig. 2. Decision making framework for changing vertical coordination strategies.

coordination control with the costliness of coordination errors. The match is judged better or worse under the logical principle that the more costly the errors the more intense the control needed and conversely the less costly the errors the less intense the control. Given the manner in which the coordination continuum was defined, the intensity (and, by implication, cost) of control has already been mapped into the various strategies. In other words, an assessment of a particular transaction may give rise to a decision (at this node) to move to the left along the continuum if errors are more costly or to move to the right along the continuum if they are less costly. What remains is to explain how to assess the cost of a coordination error in a particular transactions setting. Drawing upon Williamson (1973, 1975), Mahoney (1992) and Milgrom and Roberts (1992), two criteria can be used to assess the costliness of a coordination error for a given transaction: (1) asset specificity, and (2) complementarity.

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 maintain their value only in a narrow range of alternative uses. As asset specificity rises, coordination errors would become more costly since the underlying asset value would be affected adversely by such errors. For example, consider an inventory of identity-preserved (IP) grain. This is an asset that has premium value if harvested and stored without contamination. If an elevator cannot properly protect the inventory from contamination, i.e., a load of non-IP grain is bought and mixed into the inventory, then the premium value can be lost for the entire inventory. Therefore, the costliness of a coordination error (the loss of value due to the mixing of non-IP grain) is high, and the control mechanism for IP grain transactions must be more intense, i.e., contracts, field inspection, and testing at time of delivery, than a simple open market relationship.

Complementarity exists when the combining of individual activities across a transaction interface yields an output larger than the sum of outputs generated by individual activities. Alchain and Demsetz refer to this as non-separability and use the example of two men lifting heavy cargo onto a truck. If the cargo is of sufficient weight that both men are needed to do the lifting, then the output of the two working together is far superior to the output of the sum of the two men working alone (zero!). The problem with complementarity is not just one of needing multiple rather than single inputs. It is also the notion that the marginal product of each input cannot be measured and thus it is nearly impossible to pay each input its appropriate reward without close monitoring (i.e., higher intensity of coordination control). The relevant point to this discussion is that as complementarity between transacting parties rises the costliness of coordination errors will rise because errors will result in losing the gains from the complementarity. A good example of how complementarity has changed in the food system arises from consumer desire to have foods with less pesticide residue. Food manufacturers and retailers cannot assure the residue level in foods they sell unless they coordinate through the market chain in such a way that farmers are not applying pesticides inappropriately. By their actions alone, manufacturers and retailers cannot assure what the end consumer wants. Only through controlled coordination with the farmer can the marketing chain produce the desired end product (whether the farmer gets adequately rewarded for reducing pesticide residuals depends upon programmability and feasibility, the next two nodes in the framework).

The costliness of a coordination error thus rises with both the level of asset specificity and the level of complementarity. Managers need to assess both of these variables relative to specific transactions and then select a coordination strategy that matches the intensity of control with the costliness of coordination error. Much work remains to operationalize this concept of matching strategy and coordination error cost, but such work is crucial to helping managers make reasoned decisions about coordination strategy.

If another coordination strategy offers a potentially better match between costliness of coordination errors and coordination control intensity, then a third question becomes relevant to the strategy change process: Is the potential alternative programmable? Mere existence of a potentially better strategy for controlling coordination errors is not enough for

adoption. The decision maker must now ascertain if effective, specific management routines exist for making the potential strategy workable. For example, take a potato producer who has always used spot market transactions but has now lost a major customer to another producer who was willing to enter into a specifications contract desired by the customer. Unless this producer has a rather specific idea of how to create and evaluate the merit of a specifications contract, he is not in a good position to adopt such an alternative strategy. This characteristic of coordination strategies having effective, specific management routines will be referred to as programmability.

Milgrom and Roberts (1992) concept of design attributes in coordination helps add support for both the question on costliness of coordination errors and this question on programmability. They argue that managed coordination (high intensity of control) is appropriate when design attributes are present in the transaction. Design attributes are present when (1) errors of fit in coordination are costly (this is relevant to the first two questions in the framework), and (2) *a priori* information exits about the optimal form of the coordination solution. This second attribute is effectively the programmability issue. In making the programmability determination, decision makers must go beyond their own experience (which is likely to be based on bounded rationality) to search for effective specific coordination strategies used by others in like settings. If a programmable alternative can be found, then the decision maker can proceed to the next step in the change process.

The fourth relevant question becomes: Is the potential alternative implementable? Programmability only assures that specific management routines exist. It does not assure that a specific decision maker can effectively implement the routines. Implementability can be conceived as arising from four conditions.

1. *Capital availability*: Does the decision maker have the capital required to implement the strategy? Implementing vertical integration is the easiest of the strategies to associate with significant outlays of capital for implementation. But each alternative strategy has capital implications. For example, delivering on a specifications contract can require substantial investment in assets to produce the specifications.
2. *Existence of compatible partners*: Does the decision maker have a transacting partner who will meet the needs of the strategy being implemented? With control based on mutual interests, relation-based alliances have the most obvious need for a compatible partner. A decision maker considering such a strategy should consider such things as strategic and corporate culture compatibility. Compatibility will help assure mutual interests. However, compatible is relevant to all other strategies as well. Even in spot markets, a compatible partner can be defined on such characteristics as comparable market power that helps limit opportunism.
3. *Control competence*: Given that each coordination strategy has a different intensity of control, decision makers must examine their competence in exercising the type of control required by the strategy to be implemented. Willingness as well as skill are key to competence. Many agricultural produces are comfortable with spot market arrangements because they view themselves as having the ''horse trading'' skills relevant to spot transactions. Few have much experience or willingness to engage in the levels of control needed for vertical integration.

4. *Institutional acceptability*: The most obvious test of institutional acceptability is whether or not a particular strategy is legal, e.g., not in violation of antitrust laws. However, institutional acceptability is a broader concept that defines what economic behaviors or strategies are deemed appropriate by given social, cultural, industrial, or group norms. Limits to firm alternatives will be defined by such norms.

Whether or not a particular alternative strategy is deemed implementable will depend on the decision makers overall assessment of the above four conditions. Any one condition may create enough concern that a ''no'' decision about change will result.

Assuming that an alternative is deemed implementable, the fifth and final question in the change process becomes relevant: Does the alternative provide a risk/return tradeoff acceptable to the decision maker? The prior steps of assessing an alternative's costliness of coordination, its programmability, and its implementability will have provided much data to the decision maker about the likely benefits and returns of the alternative and its likely costs and risks. With this fifth question, the explicit task of balancing these potential returns and risks is added to the framework. Obviously, the decision maker's risk preferences will be a critical input to answering this question. But it seems fair to predict that any alternative strategy must meet the test of providing a better risk/return tradeoff than the current strategy if change is to occur. This final node is a recognition that the final decision to change vertical coordination strategy arises from multiple criteria and must be based on an extensive set of information inputs that have been explicitly structured by addressing the yes/no decisions at the prior nodes in the model.

The framework of Fig. 2 proposes that only a ''yes'' answer to all five of the relevant strategic questions will result in a changed coordination strategy for the particular transaction in question. A ''no'' at any point stops the process from starting or continuing. A feedback loop is also presented in the framework to make it clear that the process of coordination strategy evaluation is a dynamic one. As transaction conditions, resource availability, and strategy potentials change, the chance to create less costly coordination also changes. As an industry evolves, optimal coordination strategies for individual firms within the industry may move in either direction along the continuum depending upon changes in asset specificity, complementarity, programmability, feasability, and risk/return tradeoffs.

Although it is beyond the scope of this paper to report on empirical results,[2] the authors have made a first attempt to operationalize this framework using a set of 25 producer case studies (Wysocki, 1998). The model performed remarkably well. It predicted the willingness of producers to change coordination strategy in 25 of the 25 cases. More testing and a better operationalization of the framework are needed to substantiate these initial results, but the results are promising.

4. Conclusions and issues

This paper has attempted to add to the evolving analysis of vertical coordination strategies. It has examined several interrelated topics. First, a vertical coordination

continuum can be defined that moves from low intensity of coordination control (spot markets) to high intensity (vertical integration) with three transitional stages of increasing control intensity in between (specifications contracts, relation-based alliances, and equity-based alliances). The nature of control also changes from being predominately exercised *ex ante* to the transaction to predominately *ex post*. Ownership was shown to be correlated with this continuum, but not synonymous with it, i.e., single ownership is not necessary for vertical integration, but centralized control is. In total, the first half of the paper presents an elaboration on the existing literature in this area and contributes most especially to a more detailed analysis of the shifting nature of the control processes across the middle or hybrid strategies.

Second, a decision making framework was presented to model the process that a manager could use in making decisions about changing from one coordination strategy to another for a particular transactional relationship. The framework was composed of five key questions:

1. *Is the current coordination strategy too costly*? Cost is defined here to include both the costliness of coordination errors allowed by the strategy and the costliness of operating the strategy itself.
2. *Would an alternative strategy reduce the costliness of coordination*? The primary assessment in response to this question is to match the coordination control intensity and costliness of alternative coordination strategies with the costliness of coordination errors inherent in the transaction. The key transaction characteristics to be measured are the level of asset specificity and the level of complementarity across the transaction interface. The higher the combined levels of asset specificity and complementary, the more costly are coordination errors.
3. *Is an alternative programmable*? The key assessment here is whether or not effective, specific management routines exist to make an alternative workable in the specific setting of the decision maker.
4. *Is an alternative implementable*? Four conditions are necessary to assure implementability: capital availability, existence of compatible partners, control competence, and institutional acceptability.
5. *Is the risk/return tradeoff acceptable*? A decision maker must finally assess whether or not a change in coordination strategy will improve the risk/return tradeoff faced by the firm. The tradeoff depends upon the decision maker's risk preferences and the expectations for risk and return from changing the coordination strategy based on the analyses done to answer the first four questions.

The framework explicitly proposes that all five questions must be answered "yes" by the decision maker if a strategy change is to occur. A "no" at any point stops the process from being initiated or continued.

Having defined the coordination continuum more completely and developed a decision-making framework in this paper, the future research tasks need to focus on making the framework fully operational. One of the most significant issues involved in this process is the further conceptualizations needed to measure the key variables of the model. Measurement

methods must be created for asset specificity, complementarity, programmability, implementability, and the relevant risk/return tradeoff. This will be a substantial effort in its own right.

The framework does suggest a number of interesting hypotheses for future empirical research:

1. Is the decision process of managers a consecutive one as currently proposed or do these questions get considered concurrently such that very favorable responses to some of the questions might offset doubts and concerns about other questions? The predictive ability of the model hinges heavily on this issue.

2. Given that idiosyncratic resources and preferences enter into the decision process, it would be hypothesized from this framework that different strategies would be pursued by different firms in the same market. Empirically, this would be a relatively easy hypothesis to verify. What is perhaps even more interesting is whether or not long-term strategy success arises only from pursuing the most appropriate coordination strategy given the costliness of coordination errors. In other words, the total framework may help explain observed firm behavior but Question 2 on matching strategy control intensity to costliness of coordination errors may be the only relevant question for long-term strategic success. Only those firms who can make the theoretically optimal strategy programmable, implementable, and risk/return acceptable will survive.

3. Yet another intriguing hypothesis is whether or not the framework can be used in a reverse fashion. Can a decision maker based on preferences decide on a certain strategy and then move backward through the framework to set resource levels, management routines, asset specificity levels, and complementary levels that fit the chosen strategy?

4. Another hypothesis could be formed concerning the stability of the "middle" strategies across time. For example, the mutual interest foundation of relation-based alliances may make them little more than a transitional strategy given the likely instability and/or weak performance benefits of many types of shared interests.

5. Finally, what are the relevant policy hypotheses that arise from the framework? Are current anti-trust laws antiquated in this environment? Should all the options along the continuum be legally available? Will forces in agri-food markets cause convergence on one or a very narrow set of strategies along the continuum and thus make the food economy vulnerable to unforeseen risks or costs?

Vertical coordination strategy seemed a simple thing for most of the history of agriculture. After all, agriculture produced commodities that seemed best traded in open markets or transformed through vertically integrated processors. Cooperatives were also present as a third way. But, the events overtaking the hog industry and other agri-food markets have shown that agriculture is susceptible to rapid change, and the possibility of effective operations at any point along the vertical coordination continuum are real. Further work is needed to convert these possibilities into doable strategy for specific firms and for specific transactions and transactional relationships.

Notes

1. Thorn Apple Valley was recently purchased by Iowa Beef Producers and MLE merged with Southern States Cooperative. The original alliance is thus no longer in force.
2. A separate article on the empirical testing of the framework is currently being prepared by the authors.

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