

# Revisiting Agency and Transaction Costs Theory Predictions on Vertical Financial Ownership and Contracting: Electronic Integration as an Organizational Form Choice

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**This paper provides an organizational economics foundation to guide managers in matching the comparatively more efficient organizational mode with transactional characteristics such as: (1) the degree of (human capital) asset specificity involved in the transaction, (2) the degree of uncertainty surrounding the transaction, and (3) the number of trading partners (suppliers and buyers) in the vertical supply chain. The key role of technology, and more specifically the e-business infrastructure and its effects on organizational mode choice, is highlighted. The main results from this analysis suggest that changes in information technology are changing the nature of transaction costs leading to more efficient management through an electronic integration solution thus favoring contracting and outsourcing than would have been technologically possible when Williamson's *Markets and Hierarchies (Markets and Hierarchies: Analysis and Antitrust Implications*. Free Press: New York, 1975) was published. It is emphasized that the transaction cost economics principles are durable but that the breathless advances in information technology, especially in the past decade, have comparatively favored lower transaction costs of markets over hierarchies. Copyright © 2006 John Wiley & Sons, Ltd.**

## INTRODUCTION

In recent years there has been increased research attention devoted to the corporate strategy of vertical integration and especially trends toward vertical de-integration via strategic outsourcing (e.g. Sanchez and Mahoney, 1996; Leiblein *et al.*, 2002; Leiblein and Miller, 2003). Internet informa-

tion technology and e-business derivatives are transforming business practices, especially vertical coordination (Bakos and Brynjolfsson, 1993a; Hitt, 1999; Bharadwaj, 2000; Orlikowski and Barley, 2001), which is the focus of this paper. Although an increasing number of business enterprises are building and implementing e-business infrastructure in their current business models, little academic research has focused on the theoretical foundations and conditions of economic success for this new emerging form of business organization via electronic integration.

This paper attempts to fill this research gap and to provide additional theoretical insights

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concerning vertical supply chain management and business options for input procurement from organizational economics and business-level strategy perspectives. Firms' efficient organizational form choice in the area of supply chain management, and more specifically the 'make-or-buy decision,' is increasingly an important economic value-driver, and firms in different industries are increasingly competing—perhaps a better description is experimenting—with alternative supply chains for achieving vertical coordination in an attempt to minimize their operating and transactions costs and to enhance the economic value of their product offerings and services.

The current paper provides a conceptual framework based on the integration of constructs derived from transaction costs theory and agency theory to help explain and predict the use of alternative supply chain management options and firm-level organizational modes for achieving an economic cost-minimizing vertical coordination solution. Based on a transaction costs economics analysis, we explain and predict why Williamson's (1985; p. 73) hybrid relational contracting alternative (via electronic integration) is increasingly favored over both the spot market (price mechanism) and vertical integration (hierarchical) solutions (Shapiro and Varian, 1999). This outcome is mainly due to the substantive economic cost savings that often result from streamlining supply chain operations, which typically translates into increased firm-level economic profitability. Such economic costs savings are now possible because information technology has reduced the transaction costs of using electronic integration as a *substitute* for vertical financial ownership.

More specifically, this paper maintains that Internet technology and e-commerce software development continue to change the way post-industrial businesses are governed. By altering the traditional organizational model of the firm (i.e. hierarchy) and facilitating a faster, more flexible and efficient exchange of goods and services, as well as ideas and information flows between different firm's stakeholders (e.g. managers, suppliers, employees, customers, capital providers and regulators), a cost-efficient IT infrastructure can economize on significant (pre- and post-contractual) transactions costs (Williamson, 1996), while potentially accumulating economic (quasi-) rents and internalizing and protecting valuable intellectual assets such as supplier relationships, specific

human capital investments, and customer relationships (Shapiro and Varian, 1999).

The paper proceeds as follows: first, the organizational economics theoretical framework for analyzing make-or-buy decisions is presented. Second, the conditions and hypotheses for selecting each alternative organizational form option in input procurement methods are developed. The paper concludes with some implications for business practices and suggestions for future research in this organizational economics area.

### AN ORGANIZATIONAL ECONOMICS APPROACH TO ORGANIZATIONAL FORM CHOICE

Coordination and (production and transaction) cost minimization have usually been a goal of a firm's managerial decision-making. How managers achieve economic cost minimization via the choice of organizational form (that can contribute to sustainable competitive advantage) is a core concern of the current paper. In deciding on a particular organizational form along the continuum from short-term contracts to complete financial ownership a manager needs to evaluate the following contributions to economic value (Mahoney, 1992b; Mahoney *et al.*, 1995):

1. Increasing revenues (e.g. increasing market power [while respecting anti-trust law]) (Bain, 1968; Scherer and Ross, 1990).
2. Reducing costs, for example, by lowering production costs via economies of scope and by reducing transactions costs (Teece, 1980, 1982; D'Aveni and Ravenscraft, 1994).
3. Reducing risks in ways that cannot be replicated by the shareholders (see e.g. Spiller, 1985; Helfat and Teece, 1987; Chatterjee *et al.*, 1992).

Production costs are typically easier to define and measure than transaction costs. Nevertheless, transaction costs are often acknowledged to be important and critical components of the total economic costs for a particular firm in a given industry. Transactions costs include the *ex ante* economic costs of: (1) search and information costs, (2) drafting, bargaining and decision costs, and (3) costs of safeguarding an agreement. *Ex post* economic costs include: (1) costs of measuring input, (2) costs of measuring output, (3)

monitoring and enforcement costs, and (4) adaptation and haggling costs (Williamson, 1985).

The thesis of transaction costs theory is that the particular organizational form chosen to implement the strategy of vertical integration serves mainly economic efficiency purposes (Coase, 1937). Williamson (1996) develops a theoretical framework for explaining and predicting severe market frictions. The fundamental idea is that contractual difficulties can be anticipated when some opportunistic agents (Williamson, 1975; Anderson, 1988) engage in frequent transactions in an environment of sufficient (demand and/or technological) uncertainty to surpass bounded rationality capabilities (Simon, 1982). The contractual risk of some opportunistic agents utilizing asymmetric information to their advantage—and thus potentially leading to adverse selection, moral hazard, and economic hold-up problems—is high in such business environments and vertical financial ownership is one adaptive response to this inadequacy of classical market contracting.

Contractual problems can become acute when there is a small-numbers bargaining condition, which is an economic situation that often occurs when transactions involve human, physical or site 'asset specificity' (Williamson, 1979; Choate and Maser, 1992; Whyte, 1994). Human asset specificity involves uniquely related learning processes and often involves teamwork as well (Masten *et al.*, 1989). Physical asset specificity includes requirements for specialized machine tools and equipment (Caves and Bradburd, 1988). Site specificity occurs when unique locational advantages exist, as, for example, when a power plant is located near a coal mining area to save on transportation costs (Joskow, 1985).

Transaction costs economics (Williamson, 1985; Krickx, 1995) provides theoretical insight into the roles of uncertainty (demand and technological), and of asset specificity (physical, human, and site). Vertical financial ownership (Dow, 1987)—which entails a hierarchical authority relationship and residual rights of control from an incomplete contracting perspective (Grossman and Hart, 1986; Bakos and Brynjolfsson, 1993b; Brynjolfsson, 1994; Kim and Mahoney, 2005)—is more likely to reduce economic costs under conditions of asset specificity. In fact, transaction costs theory emphasizes the role of asset specificity in influencing the choice of organizational form but typically neglects the interactive effects of

measurement problems (e.g. Barzel, 1982; Eisenhardt, 1985) that have been highlighted by agency theory.

While the principal-agent model typically emphasizes the moral hazard problem (Holmstrom, 1979; Levinthal, 1988), the positive agency theory research literature (e.g. Alchian and Demsetz, 1972; Jensen and Meckling, 1976) typically emphasizes the critical role of measurement uncertainty in influencing the choice of organizational form. Indeed, positive agency theory emphasizes measurement costs but neglects asset specificity (Joskow, 1985; Mahoney, 1992b). The current paper maintains that combining these two economic efficiency perspectives enables us to make better explanations and predictions and to offer better economic cost-minimizing prescriptions on the make-or-buy decision.

The agency perspective emphasizes information asymmetry issues. A significant aspect of information asymmetry in organizations is the economic problem of ascertaining and rewarding individual effort in team production (Jones, 1987; Poppo and Zenger, 1998). Asymmetric information (between principals and agents) due to team production leads to the so-called 'nonseparability problem' (Alchian and Demsetz, 1972). If the economic reward cannot be effectively made contingent on output, it may be necessary to have a manager to monitor behavior or effort (Barzel, 1982; Ouchi, 1979). A second important agency theory variable concerns knowledge of the transformation process or 'task programmability' (Eisenhardt, 1985; Ouchi, 1979). Low-task programmability reduces the effectiveness of monitoring effort.

A partial integration of transaction costs theory and agency theory yields task programmability, nonseparability, demand uncertainty, technological uncertainty, and asset specificity as five key transactional characteristics that influence the economic cost-minimizing choice of organizational form (Mahoney, 1992a, b). Although each of these variables has been operationalized in the extant organizational economics research literature, no single empirical study has considered all five variables simultaneously. In the current paper, we revise and extend the conceptual table in Mahoney (1992b) to include electronic integration via Internet technology and the competitive environment as additional crucial elements in the decision process for the economic cost-minimizing organizational form choice.

Table 1, adapted from Mahoney (1992b), suggests an integrative organizational economics theory of corporate vertical coordination and organizational form choice under conditions of agency costs, transaction costs (mainly the degree of asset specificity), and relationship-specific Internet technology availability and investment. Drawing together empirical evidence from two fields of inquiry—strategic management and organizational economics—and applying insights from two theoretical perspectives—transaction costs theory and agency theory—while incorporating technology breakthroughs such as Internet platform and interfaces, it offers a more integrative organizational economics approach to the choice of organizational form than previously available.

In its simplified form—which assumes a sufficiently high level of technological and demand uncertainty to necessitate incomplete contracting—Mahoney (1992b) provides a combined agency and transaction costs framework, which is expressed in eight different transactional characteristic scenarios that the business enterprise might encounter. In the current paper, we suggest that there are different organizational form implications for *technological* uncertainty vis-à-vis *demand*

uncertainty. Moreover, this paper contributes to the organizational economics research literature by providing an extension of the theory to include electronic integration via the IT system, which represents another eight scenarios and emphasizes the critical agency variable of output nonseparability. Fundamentally, electronic integration via the IT system is a substitute for hierarchy for at least four reasons: (1) the IT system frequently leads to *ex ante* codification of the responsibilities of each contractual party; (2) the IT system provides more timely measurement of output; (3) the IT system reduces nonseparability problems of team production, which enables better assessment of individual firm-level productivity; and (4) a relationship-specific IT system provides a mutual sunk cost commitment to attenuate contractual hold-up problems and, thus, serves a key functional role that was formerly served by hierarchy. We now consider the eight scenarios below.

When the output of the individual is easily measured (a low nonseparability problem) and asset specificity is low (cases 1 and 5), the ease of input measurement (task programmability) is not consequential for achieving economic efficiency because in either case compensation can be based

**Table 1. A Conceptual Framework for Predicting Organizational Form in the presence of IT Systems: Agency and, Transaction Costs Considerations**

		Low-task programmability		High-task programmability	
		Low asset specificity	High asset specificity	Low asset specificity	High asset specificity
Low non-separability	No IT system	1: Spot markets	2: Long-term contracts	5: Spot markets	6: Equity joint ventures
	With IT system	1a: Spot markets	2a: Electronic contracts (B2B)	5a: Spot markets	6a: Strategic alliances
High non-separability	No IT system	3: Relational contracts	4: Clans	7: Inside Contracting	8: Hierarchy
	With IT system	3a: Internal contracts (B2E)	4a: Relationship-specific IT system	7a: Internal contracts (B2E)	8a: Hierarchy OR relationship-specific IT system

*Definitions* Low-task programmability: Observing input (effort) is a poor measure for making rewards. High nonseparability: Observing output is a poor measure for making economic rewards to individuals or organizations (if outsourcing applies). High asset specificity: Human, physical and/or site firm-specific investments are high. Spot markets: The price system works smoothly. Long-term contracts: Obligations of principals and agents are specified and enforced by third parties (courts). Short-term contracts: Same as above but shorter in duration. Electronic contracts (B2B platform): Same as above with longer duration supported by a B2B platform. Relational contracts: Obligations of principals and agents are specified and self-enforced. Social conditioning is applicable. Inside contracting: A hybrid arrangement between contract and hierarchy that is best described as a 'manager as monitor' setup. Internal contract (B2E platform): An IT system directed to coordinating information flows internally between management and employees. Equity joint ventures: An equity agreement whereby a separate entity is created. Strategic alliances: Cooperative partnerships between two or more rivals in one industry to achieve a win-win situation (outcome is superior to that found in a Nash equilibrium in a prisoners' dilemma game) Hierarchy: A superior-subordinate relationship and financial ownership. Clan: organization that is based on a vital sense of human solidarity. Relationship-specific IT system: Mutual sunk cost commitments in an IT system are made by both firms (e.g. Wal-mart and P&G).

on the output. Consequently, in both business cases, the market mechanism (spot market prices) predictably works smoothly. Vertical financial ownership can add very little to these transactional characteristic scenarios; it is unlikely to be considered, and is highly unlikely to be the efficient economic cost-minimizing organizational form choice. Since asset specificity is low, the process of competition provides few degrees of freedom for agents to behave opportunistically. Since there is a low nonseparability problem, there is little need to monitor input. Economic reward that is based on output, such as a piece rate system, is expected to work well. Thus, the price system is the predicted organizational form choice for economically achieving vertical coordination.

In this business case, an economic investment in a relationship-specific IT system to coordinate the vertical supply chain might not be needed since the market mechanism is expected to function well (cases 1a and 5a). Furthermore, a generic, unsophisticated form of an IT system would be sufficient to support production and business-level activities under these transactional conditions. When the output of the individual is easily measured (a low nonseparability problem) and asset specificity is high (cases 2 and 6) a long-term relationship is required in order for the contractual parties to be willing to invest in high sunk cost investments (high asset specificity). Although high asset specificity is present, a low nonseparability problem suggests that hierarchy is less essential than is maintaining a long-term economic relationship of some kind (Alchian and Demsetz, 1972). The *type* of long-term relationship chosen will be influenced by the ability to measure input behavior (Ouchi, 1979; Eisenhardt, 1985). If task programmability is high (case 6), an equity joint venture allows a more refined monitoring system to develop and is predicted to be an effective economic cost-minimizing organizational form. If task programmability is low (case 2), a long-term contract that stipulates output performance and is enforced by courts is the predicted organizational form choice because monitoring the effort (inputs) is not effective due to low-task programmability.

When the firm invests in an IT system under conditions of high asset specificity, a low nonseparability problem, and high/low-task programmability (cases 2a and 6a), the predicted organizational form choices for achieving an economically efficient vertical coordination solu-

tion would result in electronic contracts—rather than a standard long-term contract—in the low-task programmability transactional condition, and in strategic alliances (Gulati and Singh, 1998)—rather than equity joint ventures—in the high-task programmability transactional case. These changes in predictions (in comparison to the pre-information technology era) are warranted theoretically on the basis that an economically cost-effective IT system enables the formalization of tasks because the act of codifying the nature of exchange reduces measurement uncertainty and thus facilitates input monitoring and verifications. Therefore, electronic integration can potentially eliminate the need to write and to enforce costly and risky long-term contracts (Clemons and Row, 1991; Gurbaxani and Whang, 1991; Clemons *et al.*, 1993; Bensaou, 1997; Santhanam and Hartono, 2003; Tippins and Sohi, 2003). Moreover, when task programmability is already high (case 6a), and given the availability of a relationship-specific IT system to support exchange in the presence of high asset specificity, contracting partners may not need an equity joint venture, but could rather benefit from their mutual synergies and economies of scope through (nonequity) strategic alliance arrangements.

When the output of the individual is difficult to measure (a high nonseparability problem) and asset specificity is low (cases 3 and 7) a long-term relationship is not required due to low switching costs (low asset specificity). When task programmability is low (case 3), some type of relational contract (Williamson, 1979; Macneil, 1980; Eccles, 1981) that inculcates cooperative attitudes is required since both output control and behavioral control are ineffective as a consequence of a high nonseparability problem and low-task programmability. Cooperation must be achieved by a 'self-enforcing agreement' (Klein, 1985) or 'private ordering' (Williamson, 1985) rather than by reliance on third-party enforcement.

A business situation in which there is low asset specificity (e.g. near perfect labor markets), a high nonseparability problem, and there is high-task programmability (case 7) precisely describes the conditions posited by Alchian and Demsetz (1972). Williamson (1975, pp. 95–98) argues that the 'inside-contracting' system (Buttrick, 1952) is the real world organizational form that most resembles the Alchian and Demsetz (1972) 'manager as monitor' model. Departments in the

inside- contracting system are paid by a piece-rate, however, team production may exist *within* a department and thus a manager is required to mitigate potential opportunistic behavior (e.g. reducing quality).

By investing in a relation-specific IT system, the firm could increase the effectiveness to monitor input and to measure output by incorporating product and/or service performance measurements and by clearly formulating expectations while highlighting specific tasks and decision rights to different layers of management and employees within the organization. These transactional characteristics seem to be well-served by a B2E (or business-to-employees) interface where the relevant information about the firm's regular business activities would be available for key employees to act on and to use in their decision-making processes. Such an interface would not only avoid the costs of social conditioning in relational and inside contracts in the base case (where no IT system option was available) but would also promote more responsibility and creativity from employees while reducing bureaucratic layers in management and project implementation.

When individual output is difficult to measure (a high nonseparability problem) and asset specificity is high (cases 4 and 8), contractual problems become acute. The transaction characteristics combination of high-task programmability, high asset specificity, and high nonseparability (case 8) contains the classical transactional conditions for when vertical financial ownership (hierarchy) is the preferred economic cost-minimizing organizational form choice (Williamson, 1985). With an investment in a specialized IT system to facilitate transactions and information processing and exchange (case 8a), hierarchy may still be the preferred cost-minimizing organizational model since information and management could be centralized and important coordination costs (both internal and external) could be saved while synergies such as economies of scope are realized. We hasten to add, however, that in some cases, mutual sunk costs commitments in a relationship-specific IT system may *substitute* for hierarchy, since the mutual sunk costs commitments can support exchange and reduce the possibility of economic hold-up (Williamson, 1983; Blankenburg Holm *et al.*, 1999; Subramani and Venkatraman, 2003; Kim and Mahoney, 2006) without necessarily resorting to hierarchy (e.g. the system

shared by P&G and Wal-mart). How often such vertical de-integration is the economic cost-minimizing organizational form choice over hierarchy is an empirical question. However, the current paper highlights the existence of this alternative organization form that was not available in the past for attenuating economic hold-up problems.

When there is a high nonseparability problem, when asset specificity is high and when task programmability is low (case 4) we have the worst-case transactional characteristics for achieving efficiency. In this business case, Ouchi (1980) prescribes a clan relationship in which (personal) trust and human dignity are emphasized and opportunistic attitudes are transformed in favor of human solidarity. The inculcation of moral values and cooperative attitudes are considered a viable solution to an otherwise intractable economic dilemma (Barnard, 1938; Miller, 1992).

Finally, in the case of low-task programmability, high nonseparability, and high asset specificity (case 4a), a relationship-specific IT system is predicted to minimize the agency costs of monitoring, economic bonding and the residual agency loss (Jensen and Meckling, 1976) in this transactional case. Furthermore, third-party enforcement would be more effective if transactions are electronically accessed, processed and management decisions made more observable (Brynjolfsson *et al.*, 1994).

#### **ELECTRONIC CONTRACTING AND ORGANIZATIONAL FORM CHOICE: RESEARCH HYPOTHESES**

Now that we have revisited the eight scenarios of Mahoney (1992b), we revisit the research hypotheses provided in Mahoney and Lajili (1997) and focus on the organizational form choice of outsourcing via contracting and spot transactions using the internet and e-business platforms rather than the vertical financial ownership solution (Ang and Straub, 1998; Crowston *et al.*, 2001; Lam and Tan, 2001; Macher *et al.*, 2002). The transactional characteristics under which contracting via electronic integration is comparatively more efficient than vertical financial ownership are the core of this new and revised organizational economics framework. The objective is to explain and predict the matching of transactional characteristics and

cost-minimizing organizational form choice under a new competitive landscape where the option of *substituting* (a relationship-specific mutual sunk cost IT system) for a vertically integrated hierarchy is an available organizational option that had previously not been available.

We now focus on transaction costs economics logic to explain and predict the choice of organizational form. Transactions costs theory suggests that increased frequency will increase the likelihood of vertical financial ownership (Williamson, 1985) and empirical evidence has been corroborative (e.g. Anderson and Schmittlein, 1984; Klein, 1989; Heide and Miner, 1992). The economic logic supporting this prediction is that the transaction costs economic savings from owning the upstream segment of the business will be sufficiently high to support vertical financial ownership when exchanges are recurrent and frequent. This economic outcome was the case, for example, for the auto manufacturing industry in the 1970s (Monteverde and Teece, 1982). However, the business solutions for minimizing transaction costs are changing in recent years because these economic costs savings can now be realized without having to resort to vertical financial ownership of the upstream segment. An alternative organizational form option today that simply was not available three decades ago is to have an adequate B2B information infrastructure in place to achieve needed vertical coordination and adaptation (Malone *et al.*, 1987; Powell and Dent-Micallef, 1997; Dewan *et al.*, 1998; Sambamurthy *et al.*, 2003). This organizational form choice of *electronic integration* frequently facilitates and supports recurrent exchange and reduces transaction costs in comparison to the vertical financial ownership solution because electronic integration not only codifies the nature of exchange process reducing measurement uncertainty but also can enable mutual sunk cost commitments to support exchange (Zaheer and Venkatraman, 1994; Sanchez and Mahoney, 1996; Baldwin and Clark, 2000; Langlois, 2002; Garud *et al.*, 2003; Kim and Mahoney, 2006).

In addition to the theoretical reasoning provided above, another economic logic supports this paper's prediction that greater frequency of transactions might actually lead to a *greater* reliance on contracting. Klein and Leffler (1981) provide an economic model where an increased frequency of transactions may lead to less oppor-

tunistic behavior since the shadow of the future will result in the discounted economic value of future profitable opportunities making it less likely that a firm will behave opportunistically for short-term gain. In such a case, the market/contracting mechanism itself is 'self-enforcing' and thus economic market forces can ensure economic performance when frequency is high. The theoretical arguments above lead us to our first hypothesis:

*Hypothesis 1:* Electronic contracting will be preferred to vertical financial ownership when there is *high* frequency of exchange.

'Thin markets' increases the likelihood of costly (small-numbers) haggling in contractual exchange and increases the likelihood of vertical financial ownership (Williamson, 1975). Once again, the empirical evidence that associates vertical financial ownership with small-numbers problems has been corroborative (e.g. Levy, 1985; MacDonald, 1985; Caves and Bradburd, 1988; Knoeber, 1989; Pisano, 1990). Considering the alternative of contracting using the B2B technology platform (Mukhopadhyay and Kekre, 2002), however, may lead us to different organizational form predictions today. A B2B technology platform can reduce transactions costs (such as output measurement and quality standards). The potential of quickly and seamlessly connecting with alternative suppliers via Internet technology leads us to predict that a costly vertical financial ownership solution is not necessary. We emphasize that the logic of transaction costs theory is durable. What has changed, however, are the available technologies that offer new organizational form solutions, which minimize transaction costs. Thus, by potentially decreasing measurement costs and contractual transaction cost problems (e.g. lower switching costs and, hence, lower potential hold-up problems), outsourcing via the Internet (B2B) increases the likelihood that contracting would be more preferred than vertical financial ownership even when there are a small number of potential trading partners. Hence, the predictions are somewhat different for standard contracting and electronic contracting. Given the preceding logic, our second hypothesis follows:

*Hypothesis 2a:* Vertical financial ownership will be preferred to *standard* contractual outsourcing when there are a

small number of potential trading partners.

*Hypothesis 2b:* Electronic contracting will be preferred to vertical financial ownership even if there are a small number of potential trading partners because of potential transaction cost savings and increased efficiency benefits.

There are three major dimensions to asset specificity: site, physical, and human capital. As site specificity increases, the buyer and seller become locked-in to a relationship so as to economize on inventory and transportation costs. To achieve these economies while avoiding opportunism under transactional conditions of high site specificity, vertical financial ownership is predicted to be the organizational form choice and the empirical evidence has been corroborative (Joskow, 1985; Spiller, 1985; Masten *et al.*, 1991; Pirrong, 1993; Shelanski and Klein, 1995).

Physical asset specificity occurs when one or both parties to a transaction make investments in plant and equipment that involve design characteristics specific to the transaction. Such investments involve potentially appropriable economic quasi-rents (Klein *et al.*, 1978). Vertical financial ownership minimizes the risk of economic rent appropriation and hence is the predicted organizational form choice. Empirical evidence associating physical asset ownership and vertical financial ownership has been corroborative (e.g. Monteverde and Teece, 1982; Masten, 1984; Levy, 1985; MacDonald, 1985; Caves and Bradburd, 1988; Hennart, 1988; Lieberman, 1991; Lyons, 1995; Weiss, 1992).

Human-capital asset specificity is due to learning by doing and team experience. Once again, vertical financial ownership is the predicted organizational form choice for attenuating economic rent appropriation. Empirical evidence associating human capital asset specificity and vertical financial ownership has been corroborative (e.g. Armour and Teece, 1980; Monteverde and Teece, 1982; Anderson, 1985; Levy, 1985; MacDonald, 1985; Anderson and Coughlan, 1987; John and Weitz, 1988; Masten *et al.*, 1989, 1991; Lieberman, 1991; Masten, 1993).

When the level of asset specificity is high, we predict that vertical financial ownership will be more likely and more efficient than contracting

even if an e-business infrastructure is operational. The main theoretical reason is that highly specific assets generate appropriable quasi-rents and the more effective way to protect these economic rents is via ownership. For instance, a highly specific design for a component in an electronics or communications product would be best produced within the boundaries of the firm that originally designed it rather than contracting it out to another separate firm. The contracting and economic haggling costs associated with such highly specific assets could be substantial, which favor the vertical financial ownership solution over contracting or outsourcing.

This economic logic is quite durable and is the standard prediction (see cell 8 of Table 1). However, today a relationship-specific IT system (e.g. Wal-mart and P&G) that exhibits mutual sunk cost commitments (Kim and Mahoney, 2006) can support exchange and potentially substitute for hierarchy (cell 8a of Table 1).

*Hypothesis 3:* A high level of asset specificity (site, human, and physical capital) locks trading partners into a 'bilateral monopoly' position, which makes contracting hazardous due to potential haggling costs and 'hold-up' problems potentially very high and thus makes vertical financial ownership (or a relationship-specific IT system to align economic incentives) more likely.

Firms often face environmental uncertainty in the form of demand (volume) volatility and technological uncertainty. First, we consider the case of demand uncertainty. To the extent that volatile sales are unanticipated, fluctuations in demand may require vertical financial ownership when compared to standard (i.e. nonelectronic) contracting, and this relationship has been examined in several empirical papers (e.g. Frank and Henderson, 1982; Levy, 1985; Walker and Weber, 1987; John and Weitz, 1988; Lieberman, 1991). The economic logic to this transaction costs theory is that demand uncertainty increases the likelihood of renegotiation of contract, and that such renegotiation is hazardous under conditions of unilateral expenditures of specific assets. However, in an era of information technology, we predict that electronic contracting or outsourcing inputs using B2B technology allows the firm to adapt its

production capacity to forecasted sales and therefore to avoid unnecessary capital expenditures and full vertical financial ownership costs (Clemons and Row, 1992; Loh and Venkatraman, 1992).

In the case of technological uncertainty, Balakrishnan and Wernerfelt (1986) provide a mathematical model showing that the higher the degree of technological uncertainty the lower the likelihood of investment in firm-specific sunk cost investments and consequently the lower the likelihood of vertical financial ownership and thus the higher the likelihood of (electronic and/or standardized) contracting. The empirical evidence supports this prediction (e.g. Walker and Weber, 1984; Balakrishnan and Wernerfelt, 1986; Harri-gan, 1986).

*Hypothesis 4a:* Higher demand uncertainty favors *electronic* contracting over vertical financial ownership.

*Hypothesis 4b:* Higher technological uncertainty favors electronic (and standard) contracting over vertical financial ownership.

In the case where output measurement can be reliably measured but where the nonseparability problem is high (such as free-riding in team production), it is difficult to measure individual productivity from these output observations (Alchian and Demsetz, 1972). Inputs, including labor, need to be monitored effectively. To achieve this monitoring ability, vertical financial ownership is the predicted organizational form solution. Empirical evidence associating the nonseparability problem and vertical financial ownership has been corroborative (e.g. Anderson and Schmittlein, 1984; Anderson, 1985; John and Weitz, 1988). While transaction costs logic remains durable, (information) technologies have changed to provide alternative organizational form options.

With e-business technology, the firm can build information portals and standardized interfaces to communicate with its employees, partners, suppliers and customers (Shapiro and Varian, 1999). Such a technological solution reduces the non-separabilities problem and favors more de-integrated organizational form choices than had been possible in the past. An IT system can contribute to alleviating the difficulties of measuring outputs and individual productivities in team production settings by specifying and codifying task assignments in a shared interface and by measuring or

even capturing workflow inputs and outputs by different agents or employees in the organization. The business intelligence and related firm-level management software offered by software developing firms (e.g. SAP and PeopleSoft) illustrate these enhanced IT system capabilities to better measure individual firm-level performance and to track employee and managerial performance against established benchmarks. Such information systems would minimize agency costs of monitoring and measuring inputs and outputs and thus would enhance firm-level economic value and strategic performance (Kettinger *et al.*, 1994). This economic logic leads us to our fifth hypothesis:

*Hypothesis 5:* The e-business technology allows for lower nonseparability problems and thus increases the likelihood of an electronic contracting organizational form solution over the vertical financial ownership solution (since the reduced asymmetric information contractual problem of identifying individual firm-level productivity facilitates inter-firm business relationships).

So far, it has been argued that, on the one hand, high uncertainty (demand and technological) could be better managed by establishing a good e-business technology platform to reduce contracting costs and by streamlining the firm's operations while saving on organizational costs and avoiding the high economic costs of vertical financial ownership. On the other hand, if the degree of asset specificity in a transaction or business segment inside the firm is high, vertical financial ownership will more likely reduce transaction costs, which is a major hypothesis of transactions costs theory (Williamson, 1985). However, there are a limited number of research studies have empirically tested for interaction terms (Anderson, 1985; Walker and Weber, 1987; Lajili, 1995; Lajili *et al.*, 1997; Coles and Hesterly, 1998; Leiblein and Miller, 2003). Transaction costs logic (Williamson, 1985) suggests that high uncertainty and high asset specificity are likely to increase contractual difficulties and thus require vertical financial ownership to minimize transaction costs. Thus, our final hypotheses follow:

*Hypothesis 6a:* The interaction of high demand uncertainty and high asset specificity increases the likelihood of vertical financial ownership.

*Hypothesis 6b:* The interaction of high technological uncertainty and high asset specificity increases the likelihood of vertical financial ownership.

In summary, analyses of the conceptual map illustrated by Table 1, and the set of research hypotheses developed above, for predicting organizational form choice under firm-specific conditions of asset specificity, business risk, and uncertainty in output and input measurement, and the role of IT electronic market exchange technology (Bakos, 1991; Fulk and DeSanctis, 1995; Grover *et al.*, 1999), are highlighted. These conclusions are theoretically supported by organizational economics (e.g. agency and transaction costs) theory, and higher degrees of outsourcing via vertical contracting or relationship-specific IT-systems are explained and predicted.

#### CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This research paper identifies the transactional conditions under which *electronic integration* (e.g. contracting using information technology of the Internet) and vertical financial ownership are efficient organizational forms for minimizing transaction costs. Six hypotheses are generated by combining elements from transactions costs theory (that emphasizes asset specificity) and positive agency theory (that emphasizes input and output measurements). The main result that is new to the research literature derived from this organizational economics analysis is that business uncertainty and risk can potentially be more efficiently managed by adopting an electronic integration solution rather than a vertical financial ownership solution. This derived prediction is in contrast with the standard transactions-costs hypothesis according to which higher uncertainty will result in vertical financial ownership. The current paper maintains that it is not that the transaction costs logic is incorrect. In fact, quite to the contrary, the current paper maintains that transaction costs logic is durable. What have changed, however, are the (information) technologies and the underlying transaction costs associated with these technological changes, which have made new organizational form solutions

possible which is consistent with the de-integration trend observed in recent years.

An important business implication that follows logically from the theoretical analysis of the current paper is that for industries characterized with high business risks, it might be more efficient to de-integrate, to down-size, and to opt for an investment in a strong e-business infrastructure. In this way, vertical coordination and communication costs are reduced and the bureaucratic costs of the vertical financial ownership solution are avoided (Williamson, 1985; Mahoney, 1992b).

Another economic argument of the current paper is that the small-numbers hypothesis (Williamson, 1971) for predicting vertical financial ownership no longer *necessarily* holds in the information technology age, because vertical contracts can be more complete and *potential* competition remains strong with the capability of firms to quick connect using standardized interfaces. However, the asset specificity hypothesis for the choice of the vertical financial ownership remains fairly robust under the breakthrough of e-business as a powerful information technology and organizational tool (cell 8a of Table 1). Indeed, a high degree of asset specificity (site, physical, human capital) involves a greater risk in terms of appropriable quasi-rents and strategic and proprietary information costs that the firm needs to internalize to reap its benefits. Thus, vertical financial ownership is still the predicted mode when high levels of asset specificity are involved. This prediction would hold, for example, in the case for large high-tech firms such as those in the biotechnology and telecommunications equipment industries. However, in some business cases, such as Wal-mart and P&G a relationship-specific IT system, which features a mutual sunk cost commitment to support exchange, may substitute for hierarchy. How important such a substitution effect is, in real-world practice is an empirical question.

This paper is intended as a contribution to organizational economics and to the emerging research literature on e-business and information technology and how it affects organizational form choice for the purpose of reducing transaction costs. The theoretical framework proposed in this paper is deeply rooted in the transactions cost and agency theories and offers a more unified perspective on selecting the more efficient organizational form while highlighting the role that the internet

technology might potentially play to shift the boundaries between different organizational models. Empirical testing of the hypotheses presented in this paper could be conducted using firm-level transaction data (e.g. supply chain management decisions) and measuring the different parameters in the decision such as the degree of asset specificity, demand and supply uncertainties, information technology investment and adequate use in the supply chain management. Theoretical and empirical research at the interface of strategy and economics is fruitful and is needed in the future to improve our understanding of the dynamics of this important organizational form decision.

The transaction-cost-efficient organizational forms for firms in the 21st century are likely to be ones that are much more de-integrated and contract-based than those of the 1970s and early 1980s. Recent technology changes in the form of e-business infrastructure result in sizeable efficiency gains that are achieved by lowering communication and coordination costs between upstream and downstream segments of the value chain and by reducing measurement problems in terms of task programmability, productivity measurement and output quality measurement. Recent technology changes further enhance intra-firm and inter-firm information processing and coordination efforts while potentially reducing contractual opportunism hazards through better information sharing and monitoring. In the future, empirical research is needed to test empirically the significance of changes in coordination technologies on the various dimensions of agency and transactions costs and to aid in better explanation and prediction concerning the trends towards vertical de-integration. For this purpose, an organizational economics approach such as the one presented in the current paper could be adopted and these hypotheses can be empirically tested for value-chain analysis for firms both in B2B and in more traditional economic settings.

An important conclusion derived from this paper is that information technology has led to a lowering of the nonseparability problem of team production (Alchian and Demsetz, 1972) and consequently the measurement costs of using a market solution have been reduced. This conclusion is the main argument for why we are witnessing the trend toward vertical de-integration. We emphasize that an integrated agency and transaction costs theory provides durable

economic principles for explaining organizational form choice for vertical coordination. Technological changes, however, have changed the underlying measurement costs (Barzel, 1982) and have favored more market solutions (via vertical de-integration), over vertical financial ownership. Clearly empirical work that provides some economic sense of the magnitude of these transaction costs savings would greatly increase our understanding of the current trends toward vertical de-integration that we are currently observing in business practice (Shapiro and Varian, 1999).

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