

Collaborative Planning, Forecasting, and Replenishment (CPFR) as a Relational Contract: An Incomplete Contracting Perspective

Sung Min Kim
Cleveland State University

Joseph T. Mahoney
University of Illinois at Urbana–Champaign

Abstract

This paper analyzes Collaborative Planning, Forecasting, and Replenishment (CPFR) from an incomplete contracting perspective. In the absence of economic incentive problems, CPFR enables trading partners to improve operational efficiency through a structured process of sharing and utilizing information across firm-level boundaries. From the review of the incomplete contracts literature and a case study of CPFR arrangement, it is proposed that this IT-supported vertical arrangement also becomes the preferred governance mode as a relational contract. With efficient coordination and enhanced economic incentives for mutual commitment, CPFR allows contracting parties to avoid the difficulties of formal contracting while realizing the benefits that would be anticipated from vertical financial ownership.

Collaborative Planning, Forecasting, and Replenishment (CPFR) as
a Relational Contract: An Incomplete Contracting Perspective

Sung Min Kim *

Cleveland State University
James J. Nance College of Business Administration
Department of MLR
Office: Monte Ahuja Hall, BU 440
2121 Euclid Avenue
Cleveland, Ohio 44115-2214
Phone: (216) 687-4796
E-mail: s.m.kim@csuohio.edu

Joseph T. Mahoney

University of Illinois at Urbana-Champaign
College of Business
Department of Business Administration
Office: Wohlers Hall, 140C
1206 South Sixth Street
Champaign, Illinois 61820
Phone: (217) 244-8257
E-mail: josephm@uiuc.edu

April 7, 2006

* Corresponding author

Collaborative Planning, Forecasting, and Replenishment (CPFR) as a Relational Contract: An Incomplete Contracting Perspective

ABSTRACT

This paper analyzes Collaborative Planning, Forecasting, and Replenishment (CPFR) from an incomplete contracting perspective. In the absence of economic incentive problems, CPFR enables trading partners to improve operational efficiency through a structured process of sharing and utilizing information across firm-level boundaries.

From the review of the incomplete contracts literature and a case study of CPFR arrangement, it is proposed that this IT-supported vertical arrangement also becomes the preferred governance mode as a relational contract. With efficient coordination and enhanced economic incentives for mutual commitment, CPFR allows contracting parties to avoid the difficulties of formal contracting while realizing the benefits that would be anticipated from vertical financial ownership.

Keywords: CPFR; information sharing; relational contract; vertical integration

INTRODUCTION

This paper analyzes Collaborative Planning, Forecasting, and Replenishment (CPFR) from an incomplete contracting perspective. CPFR is a business practice wherein trading partners use information technology (IT) and a standard set of business procedures to combine their intelligence in the planning and fulfillment of customer demand (VICS, 2004). By linking sales and marketing practices to supply chain planning and execution processes, CPFR enables trading partners to improve visibility into one another's critical activities through a structured process of information sharing and joint decision making across firm-level boundaries. As a supply-chain initiative, CPFR can result in a simultaneous reduction in inventory levels and an increase in sales for both retailers and suppliers (Aviv, 2005; Schwarz, 2004). Compared to the earlier EDI-based supply chain practices, CPFR is characterized as much broader cooperative arrangements where retailers and suppliers jointly develop forecast by sharing point-of-sale (POS), inventory, promotions, strategy, and production information (Terwiesch et al., 2005).

The economic benefits of CPFR are well recognized and publicized in practice by successful retail businesses such as Wal-Mart. For example, when successfully implemented, CPFR minimizes distortion of demand information transferred from Wal-Mart to the vendors. As a result, stock-out situations are less frequent, and inventory costs are reduced. It has also been documented in research studies that the core of economic value creation in the CPFR arrangements resides in its efficient utilization of economically valuable information via a networked IT system between vertically adjacent firms (Aviv, 2002; Cachon and Fisher, 2000; Cetinkaya and Lee, 2000; Lee and Whang, 2000).

Despite anecdotal success stories, however, considerable controversy still surrounds CPFR, and most collaboration initiatives in practice have not gone beyond the pilot stage (Kurtulus and Toktay, 2004). For example, according to the CPFR baseline study by KJR

Consulting, 67% of Grocery Manufacturers of America (GMA) member companies are engaged in some forms of CPFR practice, with only 19% moving beyond pilot studies to implement CPFR with their trading partners (GMA, 2002).

Although CPFR initiative is grounded in an operational efficiency concern for the supplier-buyer relationship, CPFR reaches beyond operational issues to emphasize vertical coordination and governance of the transactions in the vertical supply chain. Without mutual commitment between contracting parties, for instance, the main concern of many suppliers with different buyers is that if they share too much information then, when there are meeting unexpectedly high demand, those with the greatest bargaining power and information will demand preferential treatment at the expense of others (Andraski and Haedicke, 2003). Such circumstances could be avoided if mutual agreements on extensive and timely information sharing were put in place to more precisely predict potential problems of matching supply and demand. But such collaborative arrangements will only be possible if there is an effective governance structure to address potential economic incentive problems between contracting parties, thereby leading to more cooperation across firm-level boundaries.

Theoretical development regarding CPFR has been underway mostly in the fields of operations management. While many papers investigate the economic value of sharing information in a supply chain, existing research on CPFR assumes that the information available to the trading partner is exogenously given, or that the information is always shared truthfully (Aviv, 2001). Under this assumption, CPFR always results in both parties being better off, which falls short of explaining the lack of widespread adoption of CPFR in practice. From the incomplete contracts perspective on vertical relationship, in the absence of the analysis of economic incentive problems inherent in this collaborative vertical contracting, the prediction of preferred organizational form will be indeterminate (Mahoney, 1992).

In order to create and implement a successful collaborative business relationship from extensive information sharing, contracting parties must invest in obtaining relevant data, further improving data quality and integrity, and generating forecasts, and then exchange their forecasts to form a single shared forecast. Since any improvement efforts by one party could benefit both contracting parties, reliance on the other party is to be increased over time as a result of repeated interactions between trading partners. When they work, such collaborative efforts allow trading partners to create economic value that no single firm could have created alone in the vertical chain. For many companies, however, the attempts could be a costly failure because, along with increased economic benefits, collaborative arrangements also present a set of economic incentive problems due to increased dependencies that can derail a firm's best efforts.

Increased reliance on others for one's own success changes economic incentives and behaviors of contracting parties within the exchange (Blois, 2002). When critical bottlenecks in the vertical chain reside outside firm-level boundaries, allocating resources externally to its trading partners can be more effective than allocating resources internally to its own activities. However, such relation-specific investments also change *ex post* bargaining positions and thus affect *ex ante* risk assessment by contracting parties. In other words, the governance mechanisms designed to assess business opportunities and monitor inputs and outputs within the firm are not suitable for successful vertical contractual relations. Absent a systematic approach for analyzing and accounting for the incentive problems arising from information sharing and relation-specific investments, the governance for a collaborative vertical arrangement will be incomplete.

Some research studies have used game theory to analyze potential economic incentive problems in vertical contractual relationships when the theory of perfect competition does not apply. As Cachon and Netessine (2004) note, however, most of the existing analytical research from a game-theoretic approach considers one-shot games. Both contractual parties can either

cooperate, achieving the Pareto-optimal outcome, or, as often predicted by the one-period equilibrium model, these parties can decide to act non-cooperatively, foregoing the economic benefits of information sharing as the classical prisoner's dilemma in game theory, which is an example of coordination failures and a non-Pareto outcome.

More recently, there has been a growing interest in the role of reputation in multi-period games (Terwiesch et al, 2005). Repeated-game models allow scholars to analyze the dynamics of the contracting parties as a relational contract when threats and promises concerning future behavior may influence current behavior.¹ In a repeated-games model, both parties consider the outcome of previous periods when deciding whether they should cooperate in the present period. Thus, the extent by which information sharing is optimal for the buyer and supplier depends on the relevant planning horizon. Especially when vertical financial ownership is not a viable option, both supplier and buyer could circumvent difficulties in formal contracting by adopting a relational contract approach to realize long-term mutual benefits from the exchange.² A relational contract allows trading partners to utilize detailed knowledge of their specific activities and to adapt to new information as it becomes available (Macneil, 1980). For the same reasons, however, relational contracts cannot be enforced by the courts and so must be self-enforcing. Therefore, research studies of repeated-games models generally suggest that each party's reputation must be sufficiently valuable that neither party wishes to renege (Gibbons, 2001).

Economic analysis of inter-firm governance in vertical relationship has primarily been based on organizational economics including transaction costs theory, agency theory, and

¹ Gibbons (2001) defines a relational contract as an evolving flexible agreement and codes of conduct that allows the contracting parties to utilize their knowledge of a specific situation and to adapt to new information, and thereby helps circumvent difficulties in formal contracting.

² A formal contract must be specified *ex ante* in terms that can be verified *ex post* by the third party, whereas a relational contract can be based on outcomes that are observed by only the contracting parties *ex post*, and also on outcomes that are prohibitively costly to specify *ex ante*.

incomplete contracting theory (Mahoney, 2005). These perspectives cover a wide range of possible contractual problems that arise from asymmetric information, bounded rationality, and relation-specific investment. Information sharing between contracting parties plays a crucial role in these theories, with the general prediction that more or better information sharing will usually improve inter-firm governance and economic performance for both parties. Although there is considerable research on several closely related economic incentive issues, there is only limited research on economic incentive problems related to sharing of information assets in contractual settings in the absence of enforceable property rights or viable vertical integration options.³ This paper provides an incomplete contracting analysis of when the increased and systematic sharing of information assets in vertical relationship can overcome a set of economic incentive problems. Specifically, it examines *when this IT-supported intermediate form of vertical contracting is the preferred governance mode in hosting vertical relationship, and how CPFR can become an effective relational contract to support economic exchange between trading partners.*

The remainder of the paper proceeds as follows. Section 2 reviews prior research studies concerning the incomplete contracts literature while focusing on the role of information sharing in relational contracting. Section 3 examines a case of CPFR arrangement between P&G and Wal-Mart. Section 4 provides theoretical propositions on the CPFR arrangement as a relational contract. Finally, section 5 presents discussion and conclusions.

³ According to Alchian and Demsetz (1973), a configuration of property rights is posited to be an economically efficient response to a contractual situation. In this respect, the CPFR arrangement can be considered an institutional arrangement to partition and allocate property rights on the valuable information assets to contracting parties in an economically more efficient way than single ownership. Helper, MacDuffie, and Sable (2000) called such arrangements as “pragmatic collaborations” through learning by monitoring – a relationship in which firms and their collaborations continuously improve their joint products and processes without the need for a clear division of property rights.

THEORIES AND LITERATURE

Incomplete Contracts Perspective

Formal contracts are incomplete in the sense that there are inevitably some circumstances that are left out of the contract, and that there will remain some residual rights of control that are not specified in the contract. Accordingly, all residual rights to the asset not expressly assigned in the contract accrue to the party who owns the asset. The allocation of the residual rights of control will thus have an important effect on the bargaining position of the parties to the contract since a party that owns the essential asset will be in a position to capture the economic benefit from the transactions which was not explicitly allocated in the contract, by threatening to withhold the asset otherwise.

According to the incomplete contracts perspective by Grossman and Hart (1986) and Hart and Moore (1990) – or the GHM models – the dilemma of providing economic incentives to the parties when the contract is incomplete can be mitigated if those parties are assured a substantial share of economic value they create by providing them with the *ex post* bargaining power inherent in asset ownership in terms of the residual rights of control. In other words, incomplete contracts approach seeks ways to improve economic incentives through ownership of essential assets. In general, the GHM models suggest that an agent who is indispensable to an asset should own that asset, and that complementary assets should be owned by the same agent when complete contracts are infeasible. However, the GHM models limit the type of assets to non-human assets, such as machines and factories, because they are alienable, and thus can change ownership.

Given the continuing information explosion, the role of intangible assets or intellectual capital, such as information, knowledge, and skills, is becoming more economically significant. The incomplete contracting view suggests that information has can be critical to the productivity

and incentives of the contracting parties. For example, Brynjolfsson (1994) extends the GHM models and considers a setting where production requires the use of physical and information assets, focusing on optimal allocation and ownership of these assets.⁴ When the two complementary assets of production – i.e., information and physical assets – are separately owned by contracting parties, net benefits from the transaction between them will be maximized by providing the strongest economic incentives for effort on the part of each party. The inter-firm governance problem can then be viewed as a matter of choosing among the feasible allocations of asset ownership one that maximizes the share of value that each party can expect to receive. If the information is not completely essential to the productivity of the physical asset, then giving the informed party ownership of the physical asset will reduce the economic incentives of the other party. Whether this is outweighed by the improved economic incentives to the informed party will be a function of how necessary the information is to the production, and how important it is to maximize the incentives of the informed party relative to those of the other party. The more important it is to provide economic incentives to the informed party, the more likely it is that it will be optimal to give the informed party ownership of the physical asset.

Following Brynjolfsson (1994), suppose we treat the information essential to economic value creation as an asset that can be alienable at different costs.⁵ This approach enables us to examine how different level of the alienability and contractibility of the information asset affects the economic incentives of contracting parties, thereby influencing inter-firm governance and

⁴ Ownership of an asset is not ownership of physical entity itself, but ownership of specific property rights to an asset or certain aspects of the asset (Coase, 1960). Thus, property rights to the information asset can be owned by different contracting parties.

⁵ According to Jensen and Meckling (1992), alienability is defined as the right to sell or transfer rights and the right to capture the proceeds of exchange. Activities within and between firms are distinguished by whether alienability is transferred to agents along with the decision rights. In this respect, contractibility of information makes it possible to transfer information across the boundaries of the firms without the rights to alienate the decision rights.

economic performance of vertical relationships. More specifically, when we compare the economic value created under the best possible ownership structure when information is alienable to the economic value created under the best possible ownership structure when information must be owned by a particular party, we can define the difference as the net economic value of alienability. In some circumstances, this net economic value can be quite large, which suggests that transforming information in a contractible form can create high economic value even without increasing the stock of knowledge itself. Economic incentives for IT investments in ways to make information alienable will be strongest if the economic value of alienability is high. In particular, the digital revolution has led to the creation of numerous alienable information assets. In addition, positive externalities of IT adoption suggest that more information will fall into this category. As a result, the reduction in information transmission costs enabled by IT is leading to substantial new approaches to the organizational challenge of co-locating information and decision rights across firm boundaries.⁶

Jensen and Meckling (1992) provide a useful framework for studying the issues of information assets, decision rights, and economic incentive structures in vertical relationships. According to Jensen and Meckling (1992), informational variables are fundamental to the structure of organizations because the quality of decisions is determined by the quality of information available to the decision maker, and therefore the co-location of pertinent information and decision rights enables the decision maker to make optimal decisions. The co-location of information and decision rights is achieved because markets function on the basis of alienable rights. Thus, alienability assures the maximization of economic values from the assets,

⁶ If information is fully contractible, then there are no residual rights so the ownership of the information is irrelevant. Making information alienable improves economic incentives by making new ownership patterns feasible, but it still falls short of the first best since any party not obtaining control of the information asset is potentially subject to being held up. In contrast, making information fully contractible could potentially give every party the optimal incentives, at least with regard to this complementary asset.

and lack of co-location of decision rights with pertinent information yields decisions that are hampered by poor information.

Co-location, however, has the potential for causing an agency problem, since the economic interests of the informed party are seldom served in ways that correspond perfectly with the economic interest of the other party in its entirety. Hence, a tradeoff arises between the use of better information and the control of behavior that fails to create the aligned economic interests of the contracting parties. The inter-firm governance in vertical relationship can be understood as an attempt to locate decision rights so as to minimize the sum of the economic costs arising from poor information and agency problems.

According to Jensen and Meckling (1992), there are two fundamental ways to bring information and decision rights together: *The information technology solution*, which transfers the information required for the decision to the decision maker, using the organization's IT systems, or *the organizational redesign solution* which redesigns the organizational structure so that the decision making authority is where the pertinent information is. The implementation of this co-location depends on the nature of the pertinent information.⁷ By definition, general knowledge, which is useful for decision making, calls for the information technology solution because it can be transferred at low cost. In contrast, when specific knowledge plays a key role in a decision, the best solution calls for restructuring decision rights so as to provide the decision authority to the one who possesses or has access to the pertinent information (since the transfer of specific knowledge is too costly). *Ceteris paribus*, the structure of organizations is an efficient response to the structure of their information costs. Thus, a change in information costs may induce a change in organizational structure. In particular, since IT has changed the costs of

⁷ Jensen and Meckling (1992) distinguish between "specific knowledge" which is localized, difficult to represent and transfer, and depends on idiosyncratic circumstances, and "general knowledge" which can be easily summarized, communicated, and shared by decision makers.

processing and transferring certain types of information, IT can change the structure of organizations by facilitating certain information flows and by turning knowledge that used to be specific into general knowledge.⁸

However, Demsetz (1992) argues that the distribution of knowledge within a firm is endogenous to management decisions. The firm decides what knowledge or information to acquire. This decision, once made, sets the knowledge content of the firm, and changes the distribution of this knowledge within and between firms. The more basic determinants of organizational structure, then, are the governance and economic incentives that influence its decision as to what stocks of knowledge to acquire and share. Therefore, in order to examine information sharing across firm-level boundaries and vertical relationships under CPFR arrangements, it is necessary to examine not only the ownership of the complementary assets, but also the economic incentives for information sharing as determinants of vertical relationships.

Information Sharing and Relational Contracts

Research studies in the incomplete contracts literature have suggested that vertical coordination and control are often achieved not by financial ownership but by dense flows of information, technology, capital, and human resources across firm-level boundaries, and these flows are backed in part by promise and reputation rather than entirely by court-enforced contracts (Williamson, 1985).

When information is shared between the vertically adjacent firms, an important governance issue is the nature or level of information sharing. For example, some retailers share

⁸ Nault (1998) examines the effects of IT on the economic profitability of alternative organization designs: centralized or decentralized. Nault (1998) reports that the IT solution, reducing the effect of the information asymmetry, can improve the economic profitability of either the hierarchy or the mixed mode through increases in both types of investment. Nault (1998) also finds that the organizational redesign solution can improve the profitability of either the market or the mixed mode through increases in both types of investments.

information related to the inventory or sales of the products while other retailers sell such information to suppliers. Initially, a retailer will choose to share the information that creates the most economic value for the retailer and that reduces the retailer's relative bargaining power the least. As the contracting parties move towards sharing more information, the relative effect that information sharing has on its bargaining position will tend to increase. At some point, the economic costs of sharing additional information will outweigh the economic benefits, and this is the point at which the retailer will stop sharing information. This approach explains why retailers share varying levels of information with different suppliers.

Seidmann and Sundararajan (1998) define four different levels of inter-firm information sharing based on the impact it has on the parties that contract to share the information to support the exchange in vertical relationship: ordering information, operational information, strategic information, strategic and competitive information. The base case of information sharing is the arrangement where the parties exchange just *ordering information* through EDI, which is the most common forms of supply chain arrangements. At this basic level, both parties gain from reduced inventory levels and cycle times but the value gained is not necessarily symmetric since each party improves efficiency independently.

Sharing *operational information* occurs when one party owns valuable information, while the other party possesses the skill to use this information more efficiently. An example of the situation is Vendor Management Inventory (VMI). If the vendor better performs managing inventory and replenishment for the exchange, this can result in economic cost savings for both parties. The vendor has specialized knowledge of the production schedule of the products in question. This firm-specific and product-specific knowledge reduces the supply-side uncertainty, which will also result in a lower average inventory for the retailer. Another economic benefit that can be achieved in this cooperative arrangement is an increase in the retailer's sales. However,

the retailer's costs of ordering and fulfillment are now borne by the vendor, which increases supply-side costs. Then, it is not clear how much the vendor gains from VMI investment. One benefit that may not be immediately tangible is the vendor's relative bargaining position for its other transactions with the retailer.

Sharing *strategic information* occurs when one party possesses information that is can derive little independent economic value from, but which another organization can use this information to generate strategic benefits for itself, and operational benefits for the other company. For example, a retailer possesses POS data on all the products it sells. This information is not of much economic value for the retailer in isolation. However, a supplier can make better demand forecasts and production planning by analyzing detailed transaction level POS information from many retailers, which is the core of economic value creation in CPFR. In the CPFR arrangement, since inventory positions can easily be derived from POS information, the operational information is also being shared. Thus, both the supplier and the retailer could gain from improved vertical coordination under the CPFR arrangement – the retailer gets improved operational efficiency and reduced transaction costs, and the supplier is able to generate accurate demand forecasts and production planning using POS information that it would otherwise not be able to access.

At the highest level of information sharing, it is possible for a retailer to allow a chosen CPFR partner to access broader market information that provides additional benefits to the vendor. When combined with exclusive category management (or category captainship) practice, the selected CPFR partner can derive strategic and competitive benefits from this *competitive information* that other competitive vendors could not access. This form of information sharing does not give the vendor competitive advantage over the retailer, but provides substantial advantage over other vendors in the same category. Especially, when the retailer deals with many

competing vendors in a particular category, endowing one of the vendors with decisions such as merchandizing product assortment, determining retail prices, and allocating shelf space over all the products supplied for that category, and providing them with the relevant POS information gives that vendor not only strategic benefits (from improved demand forecasts and production planning) but also competitive benefits (from sales and demand information about the whole product category), in addition to operational benefits (from superior inventory and replenishment management). It can further reduce the retailer's operating costs substantially – not only are all order management costs eliminated, but the retailer deals with only one vendor per category, and hence has a substantial reduction in its IT and merchandizing costs.

By developing an economic model of relational contracts, Baker, Gibbons, and Murphy (2002) further analyze collaboration incentives of contracting parties in vertical relationships. This economic model uses the theory of repeated games to conceptualize relational contracts and the boundary of the firm. In this economic model, the collaborative relationship between contracting parties takes center stage, and vertical integration decisions are regarded as instruments to provide economic incentives for relation-specific investments in the service of that relationship.

Suppose that a vendor uses the asset to produce a good that can be used in a retailer's distribution process. If the vendor's production equipment has been specialized to meet the retailer's needs, the good's economic value to the retailer will exceed its economic value to other alternative buyers, providing quasi-rents. Each party would like to capture all surpluses that the vendor and retailer can jointly achieve by transacting with each other. In this situation, the vendor will receive at least the value to the alternative buyers, and this in turn gives the vendor an economic incentive to take actions that increase the economic value in the alternative use. The vendor will give attention to the alternative buyer so as to improve its bargaining position with

the current buyer. But actions that increase the economic value in the alternative use may have no or even negative effect on the economic value to the current retailer. Thus, the vendor may find it privately optimal to take actions that give himself a larger share of a smaller total surplus in its relationship with the current retailer. Both the vendor and the retailer could be made better off if those actions were stopped.

The outcome of this repeated games model of an ongoing supply relationship depends on the size of the economic incentive to renege on a relational contract – i.e., the extent to which the economic payoff from defection exceeds the economic payoff from cooperation. Consequently, implementing the best feasible relational contract requires making the correct choice about vertical integration in a tradeoff – i.e., upstream ownership decreases the downstream party's economic incentive to renege, but upstream ownership also encourages the upstream party to consider the economic interests of alternative buyers, and hence may create an economic incentive for the upstream party to renege. In some settings, the first of these considerations is more important, so vertical integration is optimal; in others, the second dominates, so non-integration is preferred. In all settings, however, the guiding principle is to induce efficient collaborative actions and to discourage inefficient opportunistic actions by implementing the best possible relational contract.⁹ In this respect, the vertical financial ownership is not a perfect solution but merely an instrument in this quest. The relational contracts approach suggests that a potential solution is to use informal or flexible instruments, including information sharing, in tandem with formal instruments to ameliorate potential holdup problems simultaneously.

⁹ This relational contracts approach parallels Williamson's (1975) ideas, in a sense that formal contracts are almost always incomplete, and relational contracts may overcome some of the difficulties with formal contracts since relational contracts may allow the parties to utilize their detailed knowledge of their situation to adapt to new contingencies as they arise.

From the incomplete contracts perspective, however, the drawback of any relational contract is that it cannot be fully enforced by the courts. In particular, having a relational contract that utilizes the contracting parties' specific expertise typically makes it prohibitively expensive for the courts to adjudicate contractual disputes. Therefore, relational contracts must be self-enforcing, in the sense that each party's concern for its reputation and long-term gains must outweigh that party's economic incentive to renege on the relational contract (Baker, Gibbons, and Murphy, 2002). Thus, the shadow of the future subdues the temptation of the present (Macneil, 1980).

When it is too costly to vertically integrate, contracting parties might try to build effective economic deterrence to contractual holdup. The key to effective economic deterrence is to give each contractual party sufficient means to respond to any opportunistic behavior by the other contractual party. There will be insufficient economic deterrence, however, if the economic gain that one party can get from opportunistic behavior more than offsets the economic penalty the other can possibly impose. Such an economic situation can be remedied if the favorably positioned party provides the vulnerable party with an economic bond to support exchange.¹⁰

Reciprocity transforms a unilateral relation into a bilateral relationship, where both contracting parties understand that the exchange will be continued only if economic reciprocity is observed. In other words, one way to avoid contractual holdup and to thereby support economic exchange is for the buyer and supplier to devise a mutual reliance relationship (Williamson, 1983). Mutual commitment can serve to equalize the risk exposure of the contractual parties, and thereby reduce the economic incentive of any contractual party to behave opportunistically in the exchange process *ex post* (Kim and Mahoney, 2006).

¹⁰ For example, Klein and Leffler (1981) argue that franchisees may be required to make sunk-cost investments in transaction-specific capital as a way to safeguard the franchise system against free-riding and consequent quality shading, which can damage the entire franchise system.

In sum, one way to avoid inefficient actions is to expand the contractual relationship by devising a mutual reliance relationship, in which the potentially opportunistic contractual parties reciprocally invest in relation-specific assets and processes that have economic value only in the current exchange relationship (Williamson, 1983). If the non-salvageable economic value of the commitment is substantial for both the buyer and the supplier, an efficient exchange outcome is to be expected. In other words, reciprocal exposure to commit credibly to the contractual agreement is accomplished through sunk-cost investments in relation-specific assets and processes in which high switching costs are strategically incurred if any attempt is made to change contracting parties or to renegotiate contracts opportunistically.

AN ILLUSTRATIVE CASE: P&G AND WAL-MART

Initial Conditions

This section describes the development and evolution of IT-based vertical relationship between Procter and Gamble (P&G) and Wal-Mart. P&G is one of the largest manufacturers supplying grocery retailers and wholesalers and a leader in designing branded consumer goods. P&G had developed a reputation for aggressive and successful world-class development and marketing of high-quality consumer goods. The strong consumer pull provided the company with an advantage in dealing with retailers and wholesalers (Clark and McKenny, 1995).

P&G products were sold through multiple channels, with grocery retailers, wholesalers, mass merchandisers, and club stores. Relationships between P&G and the buyers through 1980 had primarily been based on negotiations over short-term initiatives and promotions. The reliance on a multitude of promotional programs increased buyer inventories and required manufacturers to also maintain large inventories in order to be able to meet the high demand

artificially created by forward buying during these promotional periods. The uncertainty of large fluctuations in periodic demand not only increased manufacturer inventory requirements but also resulted in high manufacturing costs.

Historically, information sharing between P&G and the buyers could be downright deceptive, often as a direct result of conventional business practices and economic incentives. Brand managers with meet-sales-quota-or-else directives to retail buyers are rewarded mainly based on low-cost purchase volumes. “The mind set of I win you lose has characterized this industry,” says Ralph Drayer, a former supply chain VP at P&G, “I’m trying to push product on you, and you’re trying to get a better deal from me. It was total mistrust” (Informationweek 2001). Because there’s no collaborative sharing of sales data, the supplier doesn’t see the discrepancy between what the retailer bought and what it actually sold to consumers until weeks later, if at all, from third-party research firms that aggregate and sell POS data.

Retail grocery was the most important channel for the sale of P&G products. Approximately half of all retail grocery sales volume went through chains of stores that provided their own distribution and warehousing of products, and half through wholesalers. New discount-store (e.g., Wal-Mart) and club-store (e.g., Sam’s Club) retailers supplied a limited assortment of P&G products at low margins. The more efficient distribution and merchandising of these alternative formats enabled them to offer lower prices to consumers than traditional grocery retailers, suggesting that existing processes should be improved to meet the challenge of these rapidly growing alternative formats (Westland and Clark, 1999).

Wal-Mart had provided innovations concerning many aspects of retailing, and it was well known for its heavy investment in IT. By 1987, Wal-Mart completed a \$700 million, two-year satellite communications network installation that sends data from all stores to headquarters, providing real-time inventory data. As a result, Wal-Mart merchandise was tailored to individual

markets and stores and, IT made this possible through “traiting,” a process that indexed product movements in the store to over a thousand store and market traits. Wal-Mart gave its store managers more latitude in setting prices than did centrally priced chains. Store managers priced products to meet local market conditions, in order to maximize sales volume and inventory turnover, while minimizing expenses. In 1993, an average Wal-Mart store devoted 10% of its square footage to inventory, compared with an industry average of 25%. Its operating expenses were 18.1% of discount store sales, versus the industry average of 24.6% (Foley and Mahmood, 1996).

In its vendor relationship, Wal-Mart eliminated manufacturers’ representatives from negotiations with suppliers at the beginning of 1992, and centralized its buying at the head office, with no single supplier accounting for more than 2.4% of its purchases. In its early days, a powerful supplier, such as P&G, would dictate how much it would sell and at what price. But over time, as Wal-Mart grew, its relationships with important suppliers evolved into partnerships, a key element of which was sharing information electronically to improve performance of both companies. By 1993, Wal-Mart had become P&G’s largest customer, doing about \$3 billion in business annually, or about 10% of P&G’s total revenue, and P&G was one of the first manufacturers to link up with Wal-Mart by computer.

Early Individual Efforts with EDI

To more fully understand the role that information sharing has played in the business relationship between P&G and Wal-Mart, it is necessary to understand their business relationship prior to 1988 when their business relationship was characterized as adversarial rather than collaborative, mostly pursuing their individual efficiency from day-to-day operations.

In the mid-1980s, P&G launched several projects to improve service and reduce costs across the supply channels. P&G focused on improving supply logistics and reducing channel

inventory via a process that eventually was called Continuous Replenishment Process (CRP). In 1985, P&G tested a new approach to channel logistics for replenishment ordering with a moderate-size grocery chain. This test involved using electronic data interchange (EDI) to transmit data daily from the retailer to P&G on warehouse product shipments to each store. P&G then determined the quantity of products to be shipped to the retailer's warehouse by using shipment information rather than retailer-generated orders. The results of this initial trial were impressive in inventory reductions, service improvements, and labor savings for the retailer. However, the benefits for P&G were unclear, and the new ordering process was more costly for P&G than the old one where the retailer determined order quantities (Grean and Shaw, 2002).

The role of EDI at P&G was to provide an IT platform for CRP operations. CRP can be described as two-way EDI links into the systems of trading partners in a supply channel. CRP dramatically increased the amount of data shared by companies in the channel, which made EDI essential for effective CRP implementation. In addition, P&G management approved a major rewrite of the entire ordering, shipping, and billing (OSB) system. A key element of the new system was the development of common databases for product pricing and product specifications. The common databases developed to support simplified pricing were designed to provide data directly to the buyer's own system electronically. This electronic link resulted in dramatic reductions in invoice deductions for the retailers using the new pricing database to verify or confirm purchase order information. In April 1988, P&G began shipping products based on retail sales data, placing orders automatically for the retailer.

More importantly, in order to strengthen their CPR operations, P&G overhauled its time-honored system of compensating brand managers. The company eliminated sales quotas and created business-development teams with trading partners, starting with its most important one, Wal-Mart. Product managers were asked to look at and were compensated for the success of

the entire supply chain, not just how many boxes of a particular product they pushed into the retail channel. In response, Wal-Mart suggested that P&G simply ships products on a just-in-time basis when needed using the retailer's actual sales data. To emphasize their strong commitment to the new collaborative relationship, the P&G and Wal-Mart team developed a common mission statement: "The mission of the Wal-Mart/P&G business team is to achieve the long-term business objectives of both companies by building a total system partnership that leads our respective companies and industries to better serve our mutual customer – the consumer." (Green and Shaw, 2002, p. 160). With top executives from both companies committed to rapid adoption as an organizational enabler of process improvement efforts (Lok, Hung, Walsh, Wang, and Crawford, 2005), implementation of CRP with Wal-Mart took less than two months in total.

VMI and CPFR Arrangements

In an attempt to capture more fully the advantages associated with informed decision making in the vertical chain and serve consumer needs effectively, CRP had evolved into Vendor Managed Inventory (VMI). VMI, also refer to as Direct Replenishment Process (DRP), is a vertical arrangement where the supplier takes on the responsibility of managing the inventory at the retailer's warehouse for the products it supplies. In a VMI relationship, it is the supplier who determines when stocks are to be replenished and in what quantities, rather than it responding passively to orders placed by the retailer, thereby allowing contracting parties to achieve co-location of pertinent information and decision rights in the supply chain. VMI is usually guided by a vertical contract that specifies the financial terms, inventory constraints, and performance targets such as service measures. This vertical arrangement can be mutually beneficial for the retailers and the supplier. The retailer is relieved of the burden to specify, to place and to monitor purchase orders, while enjoying guaranteed service levels. The supplier benefits from

substantially reduced demand uncertainties and safety stocks, reduced logistics costs and lead-times, and improved service levels (Aviv, 2002).

Believing that market share for P&G products would increase and the cost to serve the channel and the consumer would decline, P&G and Wal-Mart adopted VMI in the late 1980s to link Wal-Mart's inventory data at their distribution centers and replenish inventory based on movement of product through their distribution centers. Before the VMI, even when the actual demand as reflected by the POS data is relatively stable the inventory level at the warehouse may highly fluctuate because of such factors as batching and order lead-times. When the VMI arrangement is later extended to sharing Wal-Mart's demand data via EDI, the channel inventory was further reduced because of the reduced uncertainties and shorter lead-times.

INSERT FIGURE 1 ABOUT HERE

As P&G and Wal-Mart began to increase the level of information sharing from inventory to sales forecasting and planning, their VMI partnership had evolved into Collaborative, Planning, Forecasting, and Replenishment (CPFR) relationship. Manual collaborative forecasting was first implemented at Wal-Mart in 1993 by using its private exchange network and was called Vendor Forecasting. This implementation was the first retail application that utilized the integrated forecast from the automated replenishment system. CPFR was started by Wal-Mart in 1995 as an outgrowth of an internal process known as Integrated Direct Replenishment Time Series Replenishment. CPFR was coined through piloting the process with Warner Lambert. The subsequent goal was to develop industry standards for vertical collaboration using the Internet, much like what was done with EDI in the 1980's. The successful

CPFR pilot led to the creation of the Voluntary Inter-Industry Commerce Standards (VICS) sponsored by CPFR Working Group in 1996 and is in active existence today. Using private and public exchanges, CPFR became accessible to both large and smaller companies and was adopted as the best practice in the supply chains.

Because CPFR uses a set of formal procedures and technological models that are open yet allow secure communications between trading partners, it is considered the most structured collaborative business framework. Setting up a CPFR relationship with a trading partner is a structured nine-step process that has been hashed out over several years by the VICS group.¹¹ Successful implementation CPFR boils down to trading partners setting expectations up front about information sharing and joint activities, and then meeting them. The premise of CPFR is that if the retailer shares realistic sales forecast data, the manufacturer can plan production better and offer lower prices overall, rather than artificial promotions limited by time and region. Combined with electronic sharing of information over the Internet link, CPFR partners are able to engage in total supply chain visibility and forecasting.

CPFR pilot at Wal-Mart provided a structured contractual platform for joint forecasting and planning activities between Wal-Mart and its vendors that ultimately drive the replenishment process through the entire supply chain. In its CPFR partnership with P&G, Wal-Mart's marketing information is integrated with P&G's manufacturing systems to achieve effective vertical coordination across their firm-level boundaries. Furthermore, timely sharing of production and sales information allowed both P&G and Wal-Mart to make better consumer-based decisions. For example, Wal-Mart's POS data show the transaction-level information about

¹¹ CPFR consists of nine steps: 1) develop front-end agreement (roles, measurement, readiness); 2) create joint business plan (strategies and tactics); 3) create sales forecasts independently; 4) identify exceptions in sales forecasts; 5) resolve exceptions (agree on a single sales forecast); 6) create order forecasts independently; 7) identify exceptions in order forecasts; 8) resolve exceptions (agree on a single plan for orders); and 9) order generation. For more details, see Schwarz (2004) or VICS (2004).

consumer's choices, thus providing the actual demand information on what is selling and the selling price. P&G's products are then developed, manufactured, and delivered to meet those customer needs in a timely manner. By 2003, Wal-Mart has established over 600 trading partners through CPFR to reduce its operating expenses to the lowest in the industry. Successful collaboration with CPFR partners, combined with their willingness to accept a lower operating margin in order to grow overall and same-store sales, allowed Wal-Mart to price its products 10 percent below most of the competitors (Andraski and Haedicke, 2003).

However, such collaborative relationships with the vendors are still far from the norm. When asked about the effectiveness of the CPFR initiatives, Ronald K. Ireland, a former VP who was in charge of CPFR implementation at Wal-Mart, says: "It's been very effective, but not nearly to the point that we have first envisioned... There are reasons for it. A lot of the customer-facing teams, the key account teams of manufacturers, are very protective of the data that are shared – like Wal-Mart's Retail Link data. That's because Wal-Mart would shoot you if you let that data leak out to competitors. So a lot of guys are so fearful that they don't want to share that data with their own corporate headquarters, which would drive the S&OP processes. The other area where CPFR hasn't benefited as much as we wanted has to do with the behavior of retailers... what happens is manufacturers get surprised because one of their competitors is running a promotion. Wal-Mart knows about it, and the spirit of CPFR says that the replenishment analyst who has that visibility should go out to the other manufacturers and lower their forecast because it will be cannibalized. But that doesn't happen very often... The most important thing I've learned is how difficult it is to change behaviors... In a lot of cases manufacturers can't convince retail trading partners to do it" (Managing Automation, 2005).

There are two aspects of IT applications pertaining to successful CPFR implementation: technology platform and information exchange. In its technology side, the CPFR infrastructure,

as a general purpose EDI or the Internet technology, provide standard software libraries and process templates for Wal-Mart to recruit more vendors to the network so that even small suppliers could participate in the CPFR project. The timeliness of information sharing and the ability to standardize the communication process using the Internet enhance the value of CPFR, and thus facilitate the adoption of CPFR. For instance, Wal-Mart could expand the CPFR to process much of the exchanges of marketing intelligence via its website.

In its information side, however, information exchange would have many different levels of sharing, depending on the expected benefits of collaboration, even with the same technology platform. For the general vendors, it is the basic inventory information to be shared, but for the selected vendors such as P&G, it can be more sensitive information about specific products and prices, whereabouts of stores and special sales, customer preferences, and consumption patterns. In addition, the sharing of information could achieve substantial economic benefits for both parties only with proper delegation of decision rights to the dedicated CPFR partners. The co-location of pertinent information and decision rights under CPFR and category management practices further induces CPFR partners' specialization incentives to Wal-Mart's operations to realize full economic benefits from the repeated transactions in the long run.

The case study of the CPFR arrangement between Wal-Mart and P&G reveals that successful implementation of CPFR depends not only on extensive information sharing but also on mutual understanding and commitment to the dedicated partners from the repeated interactions. It grows out of first gaining an awareness of its contractual partners' business needs by asking: "what is competitive advantage to your partners? What is the competitive advantage to you if you put the squeeze on them? What kind of business environment and relationship does that create?" Thus, successful implementation of CPFR requires higher level of information sharing including the exchange of strategy, objective, and goals between partners at the beginning of a

planning period. From the increased communication through the standard procedures under the CPFR arrangement, trading partners could delegate decision rights to the informed trading partners, believing that they are working in each other's economic interest,

To sum up, the previous case provides the following insights on the CPFR arrangement. First, the CPFR arrangement improves overall visibility in the vertical chain from electronic information sharing and thus enhances operational efficiency in vertical contractual relationships. It allows trading partners to reduce inventory costs and increase retail sales by synchronizing demand forecasting and production planning. These factors provide trading partners incentives to jointly develop this IT-supported intermediate form of vertical contracting.

Second, the impact of information sharing is not merely operational. Information sharing also alters the relative bargaining power of the contracting parties in the vertical relationship. Further, developing cooperative relationship requires substantial time and efforts by both parties for mutual understanding of their interdependent activities and business objectives. Therefore, without anticipation of substantial long-term economic benefits for both parties, there are potential economic incentive problems between the contracting parties, which will make it difficult to fully extend CPFR relationships to the vendors in the vertical chain.

Third, CPFR provides trading partners a set of structured organizational procedures and technological standards where contracting parties systematically improve mutual understanding of each other's interest and business from increased communication and extensive sharing of information on interdependent value-chain activities. The structure of bilateral reliance for joint forecasting and planning under the CPFR arrangement could induce cooperative actions by CPFR partners over time toward a mutual commitment.

Finally, in the CPFR arrangement, the retailer has stronger economic incentives to specialize in collecting and sharing as much information as possible that is of competitive value

to the core vendors and the retailer. Similarly, the vendor, who has privileged access to the retailer's information and decision making authority, has economic incentives to specialize in making optimal replenishment and production decisions which will make its activities more valuable for the repeated exchange. Such specialization incentives to CPFR partners are the reinforcing factors to realize mutual economic benefits in the current relationship.

The evolving nature of vertical relationship between P&G and Wal-Mart implies that different levels of information sharing bring about different forms of vertical collaboration between trading partners over time. Consistent with the prediction from the incomplete contracts literature, the CPFR arrangement provides the contracting parties an adaptive and cooperative platform to improve operational efficiency and vertical coordination across firm-level boundaries. In particular, the case study illustrates how increased communication and joint activities between CPFR partners can lead to efficient vertical coordination through adaptive evolutionary processes. The sources of economic value creation under the CPFR arrangement are detailed, focusing on the role of IT-based information sharing and adaptive efforts between virtually integrated buyer and supplier in the retail industry.

CPFR AS A RELATIONAL CONTRACT

Lacking true collaborative relationships with trading partners, both retailers and suppliers are initially reluctant to share their proprietary information in the pilot stage of CPFR project because of the possibility that their contractual partner or competitor will take advantage of it. For instance, a retailer's sales forecasts provide information about what the retailer intends to do in a given future state of the world. These intentions, however, are not fully verifiable and cannot be enforced by the third party. The courts may not be able to distinguish between a supplier who properly reserved capacity but failed to fill the order for reasons beyond its control,

and a supplier who willfully ignored the buyer's request or abused the shared information for purposes outside the contract to its own benefits. This is an economic incentive problem under asymmetric information between self-interested buyer and supplier, and it makes efficient vertical coordination and economic value creating exchange between them difficult to emerge.

Collaborating companies need to work closely together to make the whole pie (i.e., cooperative economic value creation) bigger for everyone involved in the relationship, rather than simply to increase the size of their own piece of the pie (i.e., competitive economic value capturing). Such collaborative arrangements, which are most appropriate when the tasks and activities faced by contracting parties are highly interdependent and too complex to be resolved individually, often rely on joint activities based on a free flow of information and rich communications. For less complex and independent problems, however, simply sharing operational information and synchronizing related value-chain activities may be more efficient approach for each party to achieve their goals. Thus, contracting parties should realize that not all vertical relationships require intense collaborative efforts. In some cases, standard vertical contracting of related activities through an EDI-based straightforward exchange of operational information may be sufficient to support the exchange.

Conversely, effective collaboration is a difficult process even under the CPFR arrangement because it requires substantial specialization efforts and mutual commitment to the current relationship. An intense collaborative approach is appropriate only in situations where such efforts are justified as both parties expect substantial long-term gains from cooperation. For the vertically related firms to address highly complex and interdependent problems in the supply chain there is a need for sharing proprietary knowledge or information that other firms possess. In *standard vertical contracting*, however, sharing of information by one party could make itself vulnerable to opportunism due to the conflicts of interests between contracting parties.

More specifically, the sharing of forecasting and planning information may cause at least two types of economic incentive problems. First, from the supplier's standpoint, prior research has suggested that, in the absence of verifiable and enforceable contractual obligation for the buyer to purchase what it has forecasted, the buyer has an economic incentive to inflate forecasts to assure sufficient supply (Cachon and Lariviere, 2001). The buyer offers the supplier a contract to build capacity for a specialized component for which the supplier is the only source. To better manage its capacity and inventories, the supplier would prefer the most accurate information possible. However, the supplier often suspects the buyer of submitting phantom orders, i.e., forecasts of high future demand that do not materialize. Complicating matters, it is difficult to accuse the buyer of lying. The buyer might have truly expected high demand, but random events could still lead to a low demand realization. Fearing inflated forecasts, the supplier might prefer to delay its actions to a point in time when the buyer is willing to credibly commit to its forecast, which often results in numerous lost sales, hurting both parties. If the supplier does not trust the orders from the buyer at all, there effectively is no exchange of information and goods, leading to a market failure.

Second, from the buyer's standpoint, there is the risk of information poaching in contractual relationship: information that is transferred from the buyer to the supplier for purposes specified in the contract will deliberately be used by the supplier for purposes outside the contract, to its own economic benefit, and to the detriment of the buyer that provided the information (Clemons and Hitt, 2004). Especially when there are weak intellectual property protection, existence of complementary assets in the supplier, limited predictability, and limited observability, it becomes more difficult to deter information poaching and thus leads to less share of information between trading partners than would be optimal absent poaching risks.

Information poaching is one component of opportunistic behaviors, along with the risk of holdup when the buyer has become dependent upon the supplier's services but cannot monitor performance and abuse of power.

The research literature in organizational economics has identified a variety of possible governance mechanisms for addressing the contractual risks under information asymmetry. Many traditional remedies, however, have limited ability to address the problems of forecast inflation or information poaching. For example, the classical solution to hidden action problems is to use economic incentive contracts in which compensation to the supplier is based on some observable measure of the output. For the most part, however, these types of economic incentive contracts through standard vertical contracting have limited direct use in reducing information poaching problems because the effect of information poaching is typically difficult to observe in output. Alternatively, direct monitoring or outside monitoring like posting an economic bond may be an effective remedy, although the efficacy of input monitoring is limited by the difficulty in proving willful forecast inflation, especially if it relies on third-party enforcement with a burden of proof. Further, as discussed earlier, simply transferring financial ownership of complementary assets --- i.e., vertical integration --- may not be feasible or optimal because transferring ownership of the physical assets to the informed party (e.g., the retailer) will reduce the economic incentives of the other party (e.g., the supplier). Again, whether this is outweighed by the improved economic incentives to the informed party will be a function of how necessary the information is to the productivity of the firm, and how important it is to maximize the economic incentives of the informed party relative to those of the other party.

When explicit incentive contracts are difficult to apply in standard vertical contracting, firms can structure a relational contract where loosely defined contractual agreements set the rules for future negotiations, but remain flexible to allow ongoing organizational adaptation

(Williamson, 1985). Relational contracting is often supported by a high level of information sharing between trading partners as a part of adaptive evolutionary processes (Salvato, 2003). This relational contract works best when there are substantial gains from exchange and economic value from repeated interactions (Gibbons, 2001).

When the repeated vertical transactions are supported by the CPFR arrangement of electronic information sharing and formal organizational procedures, economic incentive problems and opportunistic renegotiation between trading partners can be mitigated due to enhanced alienability and visibility in the channel. Because CPFR uses a set of formal processes and technological models, it is one of the more structured collaborative business arrangements that place a heavy emphasis on audits and verification on the accuracy of partners' information. When high degree of non-separable team effort is required due to interdependent and complex nature of the vertical exchange, CPFR increases the capability of trading partners to program their tasks. To the extent that information and actions are observable and that relation-specific investments are reciprocal, CPFR provides an effective deterrence to *ex post* opportunism. As a set of formal inter-organizational routines, CPFR enables trading parties which perform interdependent tasks to develop shared understandings about what actions will be taken in a specific instance. These shared understandings help CPFR partners better coordinate the decisions and actions while adapting to variations in the internal and external environment (Feldman and Rafaeli, 2002). Expected gains from long-term relationship under the CPFR arrangement are the reinforcing factors that make this intermediate form of vertical contracting an effective relational contract, which is superior to standard vertical contracting.

Compared to standard vertical contracting, structuring ongoing mutual reliance is critical to sustained economic value creation from the CPFR partnership. Prior to information sharing agreement, the retailer is the owner of the information, and will therefore tend to have a

bargaining advantage during the negotiation process. However, this bargaining advantage by itself does not insure that all the economic value will accrue to the retailer, as the vendor is responsible for generating economic value from the use of the shared information and may take advantage of this fact to negotiate for a larger share. Vendors may agree to the CPFR arrangements that are initially unfavorable, as this eliminates the threat of an even more unfavorable situation where another rival vendor gets an exclusive contract for the use of strategic and competitive information with the retailer. In this situation, it is possible for the retailer to actually capture most of the economic value from the CPFR arrangements.

When there are no dominant vendors, vendors may pursue a favorable long-term contract with the retailer in order to prevent the retailer's opportunistic renegotiation or switching to other rival vendors. Therefore, it will be difficult to develop collaborative relationships with the vendors unless the retailer adopts the CPFR arrangement with selected vendors. CPFR changes their economic incentives for greater specialization to the current trading partners, which will balance their relative bargaining positions over the additional value creation from relation-specific investments – i.e., relational rents (Dyer and Singh, 1998). When there are dominant vendors in a category, as described in the case study, the bargaining considerations change. P&G was the most favorable candidate for a successful CPFR partnership with the category management practice, as efficiency gains for Wal-Mart from having P&G manage their own inventory and merchandise are high. Also, strategic and competitive gains for P&G from the CPFR agreement are also high. Thus, there are strong economic incentives for both companies to share their information, including POS data, promotions, strategy, and production constraints, thereby mutually committing to the current trading partners as a relational contract.

Returning to the initial questions of when the intermediate form of vertical contracting becomes the preferred governance and why and how CPFR an effective relational contract in

hosting vertical relationship, the theoretical development in the current paper from the incomplete contracting perspective leads to the following propositions:

Proposition 1: *As a relational contract, CPFR will be preferred to standard vertical contracting when there is high demand uncertainty for the result of interdependent activities.*

Proposition 2: *As a relational contract, CPFR will be preferred to standard vertical contracting when there is high information asymmetry between balanced contracting parties.*

Proposition 3: *CPFR will lead to sustained economic value creation when information sharing and joint activities adaptively improve visibility and mutual understanding to avoid incentive problems in standard vertical contracting.*

From the incomplete contracts perspective, CPFR also becomes an alternative governance mechanism to *vertical financial ownership*. In the strategic management literature, Mahoney (1992) identifies advantages (e.g., coordination and control, audit and resource allocation, motivation, and communication) and disadvantages (e.g., bureaucratic, strategic, and production costs) of vertical financial ownership, and suggests that every motive for vertical financial ownership may be achieved alternatively by an appropriate vertical contract when agency and transactions costs are assumed to be absent. Similarly, the current paper posits that, if agency and transactions costs can be substantially reduced under the CPFR arrangement, due to enhanced alienability and visibility in the channel, the CPFR arrangement can achieve the goals of vertical integration strategy as a relational contract without resorting to costly vertical financial ownership.

INSERT TABLE I ABOUT HERE

Within the assumptions of the incomplete contracts approach, Rajan and Zingales (1998) suggest “access” as an alternative mechanism to vertical financial ownership for economic value creation and control in vertical relationship, defining access as the ability to use, or work with, a critical resource. The party who is given privileged access to the resource gets no new residual rights of control. All the supplier gets is the opportunity to specialize its own assets to the resource and to make itself more economically valuable. If the critical resource is information, access implies being able to utilize the broad range of economically valuable information that the retailer possesses. The amount of economic value creation that the supplier gets from privileged access to the retailer’s information is often more contingent on “indirect capabilities” (Araujo, Dubois, and Gadde, 2003) of making the right relation-specific investment to the current trading partner (for example, by making optimal replenishment and production decisions) than the economic value creation that comes from vertical financial ownership itself.

The negative effect of vertical financial ownership stems from the difference in the economic value of the asset outside the current relationship before and after the relation-specific investment. The greater the outside options are lost by specializing, the less an owner is willing to specialize. This effect disappears if there is no alternative use the asset can be put to even prior to the specific investment. In the incomplete contracts framework, if the economic value of the asset outside the relationship increases with the investment made specifically for the relationship, then the economic value of the owner’s threat to withdraw assets, and its share of surplus, increases with specific investment. Hence ownership can provide the owner with economic incentives for specialization even though investment is not directly contractible. In order to be effective, however, ownership rights require some outside authority to enforce it. Assumptions that courts perfectly enforce contracts are not quite satisfactory in practice. Without an effective outside enforcer, vertical financial ownership has limited practicality.

When the tasks are highly interdependent, the right to offer access belongs to anyone who has command over complementary assets for relational rents. The regulation of access can be used as a governance mechanism to foster relation-specific investments even absent an exogenous enforcement system. In the case of the CPFR arrangement between P&G and Wal-Mart, P&G is given access to the information of Wal-Mart but gets no new residual rights of control over the shared information. All P&G has is the residual right to withdraw its relation-specific replenishment and production activities. What access does is to let P&G make these activities more economically valuable by giving itself the opportunity to specialize complementary assets and activities that are tailored to Wal-Mart's operations. Under the CPFR arrangement, the bargaining power over relational economic rents that P&G gets from the privileged access to Wal-Mart's economically valuable information is likely to be more contingent on making the right specialization investment than the control directly coming from vertical financial ownership. Similarly, in order to induce P&G's specialization efforts in the CPFR arrangement, Wal-Mart has strong economic incentives to generate and share valuable information with P&G as mutual commitment.

Proposition 4: *As a relational contract, CPFR will be preferred to vertical financial ownership when there is high frequency of exchange between small numbers of partners.*

Proposition 5: *As a relational contract, CPFR will be preferred to vertical financial ownership when there is high complementarity between information and production activities.*

Proposition 6: *CPFR will lead to sustained economic value creation when privileged information access enhances specialization incentives for mutual commitment without resorting to costly vertical financial ownership.*

DISCUSSION AND CONCLUSIONS

The current paper has examined recent CPFR practice in discount retail industry as a laboratory to investigate the role of this intermediate form of vertical contracting as a relational contract. By focusing on organizational economics of CPFR arrangement that has been often ignored or treated as incidental implementation issues, this paper identifies critical efficiency and governance implications of this IT-supported vertical contractual arrangement.

The case study illustrates the development and evolution of the CPFR arrangement between P&G and Wal-Mart. Initially, economic value creation from the CPFR initiative came from its efficient utilization of shared information via IT infrastructure across firm-level boundaries, which creates the co-location of decision rights and pertinent information in the vertical chain. Extensive information sharing and joint decision making under the CPFR arrangement further improved mutual understanding and visibility into their interdependent activities in the vertical chain. Reciprocal specialization effort into the current relationship was an adaptive response to the new collaborative exchange environments, which are essential to greater value creation from their repeated transactions. Over time, formerly competitive bargaining relationship has evolved into mutually cooperative one supported by the CPFR arrangement as the established system of interconnected routines (Salvato, 2003).

From the review of incomplete contracts literature and an illustrative case study of the CPFR arrangement between P&G and Wal-Mart, it is proposed that CPFR could improve not only operational efficiency but also specialization incentives for mutual economic benefits, which constitutes a relational contract in the vertical chain. As a relational contract, the CPFR arrangement enables trading partners to replicate the advantages of vertical financial ownership (i.e., efficient coordination and flexible adaptation) while avoiding the disadvantages of standard vertical contracting (i.e., incentive alignment under information asymmetry and asset specificity).

As a non-hierarchical and non-market organizational form, the CPFR arrangement provides superior governance because the contracting parties involved in this supply chain arrangement are required to share proprietary information and make relation-specific investments reciprocally to develop a long-term cooperative relationship, leading to relational rents. It is non-hierarchical because each contracting party remains independent under the contractual agreement and collaborates in ways that do not correspond to managerial directive or authority within the traditional hierarchy (Baker, Gibbons, and Murphy, 2002). It is non-market because it does not use price mechanisms or competitive switching for additional efficiency gains but motivates mutual commitment and cooperation between trading partners (Kim and Mahoney, 2006).

By examining the mechanisms of information sharing and economic incentive alignment in the CPFR arrangement, the current paper also emphasizes the importance of managing the development and implementation processes of a relational contract. In practice, successful implementation of CPFR requires the management's judgment and knowledge of complex contracting situations to make the vertical relationship more adaptive. Selecting and changing CPFR partners will be more difficult when managers must terminate one relational contract but preserve enough credibility to begin another.

The insights developed in this paper provide a base for future empirical research on the strategic use of IT and the governance of information sharing in vertical relationship. While the current paper highlighted the benefits of CPFR as a relational contract, it also recognized potential economic incentive problems related to information sharing. In this regard, the success of CPFR to create economic value and competitive advantage depends on effective governance of economic incentives and management of economically valuable information and technology across firm-level boundaries.

REFERENCES

- Alchian, A. A., and Demsetz, H. (1973). 'The property right paradigm'. *Journal of Economics History*, 33, 1, March, 16-27.
- Andraski, J. C. and Haedicke, J. (2003). 'CPFR: Time for the breakthrough?' *Supply Chain Management Review*, 7, 3, May/June, 54-61.
- Araujo, L., Dubois, A. and Gadde, L-E. (2003). 'The multiple boundaries of the firm'. *Journal of Management Studies*, 40, 5, July, 1255-77.
- Aviv, Y. (2001). 'The effect of collaborative forecasting on supply chain performance'. *Management Science*, 47, 10, October, 1326-43.
- Aviv, Y. (2002). 'Gaining benefits from joint forecasting and replenishment processes: The case of auto-correlated demand'. *Manufacturing & Service Operations Management*, 4, 1, Winter, 55-74.
- Aviv, Y. (2005). 'On the benefits of collaborative forecasting partnerships between retailers and manufacturers'. Working Paper, Olin School of Business, Washington University.
- Baker, G., Gibbons, R., and Murphy, K. J. (2002). 'Relational contracts and the theory of the firm'. *Quarterly Journal of Economics*, 117, 1, 39-84.
- Blois, K. (2002). 'Business to business exchanges: A rich descriptive apparatus derived from Macneil's and Menger's analyses'. *Journal of Management Studies*, 39, 4, June, 523-51.
- Brynjolfsson, E. (1994). 'Information assets, technology, and organization'. *Management Science*, 40, 12, 1645-62.
- Cachon, G. P. and Fisher, M. (2000). 'Supply chain inventory management and the value of shared information'. *Management Science*, 46, 8, August, 1032-48.
- Cachon, G. P. and Lariviere, M. A. (2001). 'Contracting to assure supply: How to share demand forecasts in a supply chain'. *Management Science*, 47, 5, May, 629-49.
- Cachon, G. P. and Netessine, S. (2004). 'Game theory in supply chain analysis'. In Simchi-Levi, D., Wu, S. D. and Shen, Z-J. (Max) (Eds), *Handbook of Quantitative Supply Chain Analysis: Modelling in the E-Business Era*. Boston, MA: Kluwer Academic Publishers, 13-66.
- Cetinkaya, S. and Lee, C-Y. (2000). 'Stock replenishment and shipment scheduling for vendor-managed inventory systems'. *Management Science*, 46, 2, 217-32.
- Clark, T. H. and McKenny, J. L. (1995). *Procter & Gamble: Improving Consumer Value through Process Redesign*, HBS Case #9-195-126, Boston, MA: Harvard Business School.
- Clemons, E. and Hitt, L. (2004). 'Poaching and the misappropriation of information: Transaction risks of information exchange'. *Journal of Management Information Systems*, 21, 2, 87-108.
- Coase, R. H. (1960). 'The problem of social cost'. *Journal of Law and Economics*, 3, October, 1-44.

- Demsetz, H. (1992). 'Comments on "Specific and general knowledge, and organization structure" by Jensen and Meckling (1992)'. In Werin, L. and Wijkander, H. (Eds), *Contract Economics*. Cambridge, MA: Basil Blackwell, 275-81.
- Dyer, J. H. and Singh, H. (1998). 'The relational view: Cooperative strategy and sources of interorganizational competitive advantage'. *Academy of Management Review*, 23, 4, 660-79.
- Feldman, M. S. and Rafaeli, A. (2002). 'Organizational routines as sources of connections and understandings'. *Journal of Management Studies*, 39, 3, May, 309-31.
- Foley, S. and Mahmood, T. (1996). *Wal-Mart Stores, Inc.*, HBS Case #9-195-126, Boston, MA: Harvard Business School.
- Gibbons, R. (2001). 'Chapter 7: Firms and other relationships'. in P. DiMaggio (ed.), *The Twenty-First-Century Firm: Changing Economic Organization in International Perspective*. Princeton, NJ: Princeton University Press, 186-99.
- GMA (2002). *CPFR Baseline Study: Manufacturer Profile*, by KJR Consulting for CPFR Task Force Logistics Committee, Grocery Manufacturers of America, Washington, D. C.
- Grean, M. and Shaw, M. J. (2002). 'Chapter 8. Supply-chain partnership between P&G and Wal-Mart'. in M. J. Shaw (ed.), *E-Business Management: Integration of Web Technologies with Business Models*. Norwell, MA: Kluwer Academic Publishers, 155-71.
- Grossman, S. and Hart, O. (1986). 'The costs and benefits of ownership: A theory of vertical and lateral integration'. *Journal of Political Economy*, 94, 4, 691-719.
- Hart, O. and Moore, J. (1990). 'Property rights and the nature of the firm'. *Journal of Political Economy*, 98, 4, 1119-58.
- Helper, S., MacDuffie, J. P. and Sabel, C. (2000). 'Pragmatic collaborations: Advancing knowledge while controlling opportunism'. *Industrial and Corporate Change*, 9, 3, 443-88.
- Informationweek (2001). 'The trust imperative'. by C. Wilder and J. Soat, July 30.
- Jensen, M. C. and Meckling, W. H. (1992). 'Specific and general knowledge, and organization structure'. In Werin, L. and Wijkander, H. (Eds), *Contract Economics*. Cambridge, MA: Basil Blackwell, 251-74.
- Kim, S. and Mahoney, J. T. (2006). 'Mutual commitment to support exchange: Relation-specific IT system as a substitute for managerial hierarchy'. *Strategic Management Journal*, 27, 5, 401-23.
- Klein, B., and Leffler, K. B. (1981). 'The role of market forces in assuring contractual performance'. *Journal of Political Economy*, 89, 4, 615-41.
- Kurtulus, M. and Toktay, B. (2004). 'Investing in forecast collaboration'. INSEAD Working Paper 2004/48/TM, Fontainebleau, France.
- Lee, H. L. and Whang, S. (2000). 'Information sharing in a supply chain'. *International Journal of Technology Management*, 20, 3, 373-87.

- Lok, P., Hung, R. Y., Walsh, P., Wang, P. and Crawford, J. (2005). 'An integrative framework for measuring the extent to which organizational variables influence the success of process improvement programmes'. *Journal of Management Studies*, 42, 7, November, 1357-81.
- Macneil, I. R. (1980). *The New Social Contract*. New Haven, CT: Yale University Press.
- Mahoney, J. T. (1992). 'The choice of organizational form: Vertical financial ownership versus other methods of vertical integration'. *Strategic Management Journal*, 13, 8, 559-84.
- Mahoney, J. T. (2005). *Economic Foundations of Strategy*. Thousand Oaks, CA: Sage.
- Managing Automation (2005). 'The best laid plans'. by J. Moad, June 22.
- Nault, B. R. (1998). 'Information technology and organization design: Locating decisions and information'. *Management Science*, 44, 10, October, 1321-35.
- Rajan, R. G. and Zingales, L. (1998). 'Power in a theory of the firm'. *Quarterly Journal of Economics*, 113, 2, May, 387-432.
- Salvato, C. (2003). 'The role of micro-strategies in the engineering of firm evolution'. *Journal of Management Studies*, 40, 1, January, 83-108.
- Schwarz, L. B. (2004). 'The state of practice in supply-chain management: A research perspective'. In Geunes, J., Akcali, E., Pardalos, P. M., Romeijn, H. E. and Shen, Z-J. (Max) (Eds), *Applications of Supply Chain Management and E-Commerce Research*. Dordrecht, Netherlands: Kluwer Academic Publishers, 325-62.
- Seidmann, A. and Sundararajan, A. (1998). 'Sharing logistics information across organizations: Technology, competition, and contracting'. in C. Kemerer (ed.), *Information Technology and Industrial Competitiveness*. Boston, MA: Kluwer Academic Publishers, 107-36.
- Terwiesch, C. T., Ren Z. J., Ho, T. H. and Cohen, M. A. (2005). 'An empirical analysis of forecast sharing in the semiconductor equipment supply chain'. *Management Science*, 5, 2, February, 208-20.
- VICS CPFR Committee (1999). *The Roadmap to CPFR* (<http://www.vics.org/topics/cpfr/cpfr>).
- VICS CPFR Committee (2004). *Nine-Step Process Model* (<http://www.vics.org/topics/cpfr/cpfr>).
- Westland, J. C. and Clark, T. H. K. (1999). *Global Electronic Commerce: Theory and Case Studies*. Cambridge, MA: MIT Press.
- Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.
- Williamson, O. E. (1983). 'Credible commitments: Using hostages to support exchange'. *American Economic Review*, 73, 4, 519-40.
- Williamson, O. E. (1985). *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: Free Press.

Table I. Impacts of CPFR on Organizational Economics and Inter-firm Governance

		Transaction costs due to demand uncertainty and asset specificity	
		High	Low
Agency costs due to information asymmetry and task complexity	High	Vertical integration	Relational contracting ^a ⇐ CPFR ^c ↓
	Low	Long-term contracting ^b	

a. *Relational contracting*: Obligations of principals and agents are specified and self-enforced by contracting parties.

b. *Long-term contracting*: Obligations of principals and agents are specified and enforced by third parties.

c. *CPFR*: Electronic information sharing and formal organizational procedures for joint activities in CPFR lead to improved visibility in the vertical chain and mutual understanding of business objectives and strategies. Such repeated interactions between CPFR partners induce reciprocal relation-specific investments for interdependent tasks as an adaptive response to collaborative exchange environment.

Figure 1. Evolution of SCM Practices and Inter-firm Governance

