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Governance Mechanisms For Coordination And Information Sharing In Supply Chains: The Role Of Trust

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ABSTRACT

In this paper, we describe the role of trust, bargaining power and contracts in governing information sharing and material flow coordination in supply chains. We present a conceptual framework showing how these governance mechanisms affect coordination and ultimately, chain performance. Five types of trust – calculative, competence, integrity, predictability and contractual - are thought to play an important role in determining the efficacy of information sharing. We pose three research questions on the relationships among trust, bargaining power, contracts and information sharing in supply chain coordination. An example from the retail distribution industry is used to illustrate these governance issues as key factors in the supply chain business model.

KEYWORDS

Trust, information sharing, supply chain

INTRODUCTION

Supply chain management comprises the managing of products and information flows supporting the business processes of a network of suppliers, manufacturers, transporters, warehouses, and customers (Xiande, Xie and Zhang, 2002). The objective of the supply chain is to optimize overall chain performance while delivering a product or service to the ultimate customer at minimal cost. The speed with which products are innovated, imitated and made obsolete has prompted firms to concentrate and improve on their supply chains to remain competitive. In many industries today, competitive success depends upon performance improvements at the supply chain level, where much of the ability to innovate and improve lies within the relationships forged among business partners (chain members).

If individual companies within a supply chain are not performing optimally, they can be replaced by their business partners to improve chain performance (Lewis, 2004). However, a more difficult and interesting problem occurs when individual companies are operating at an optimal level, but deficient chain performance results from poor coordination between the companies that make up the chain (Simatupang, Wright and Sridharan, 2002).

Coordination between chain partners is effected by careful sharing of information and materials. Information sharing is a key element in achieving improvements in supply chain performance as it helps to reduce “bullwhip effect” (Lee, Padmanabhan and Whang, 1997) and facilitates current business practices such as vendor-managed inventory, cross-docking and quick response (Yu, Yan and Cheng, 2001).

To succeed in sharing information, a number of critical relationships should be in place between sets of business partners. Partners in the chain must agree on a common governance structure that will direct their relationship. Trust, bargaining power (or power) and contracts are three important elements that shape interorganizational relationship governance (Alvarez, Barney and Douglas, 2003). The purpose of this paper is to present and justify a model of the role of these governance mechanisms in enabling coordination among partners in a supply chain, with an emphasis on the significance of trust in effective interorganizational information sharing. We discuss how the existence or contents of contracts affect trust, how differences in power relationships affect trust and how trust influences coordination through information sharing.

In the next section, we describe the evolving importance of supply chain as a business model. We then present a conceptual model depicting the role of three governance mechanisms (trust, power and contracts) in information sharing and material flow coordination. We propose research questions on the relationship between our construct of interest, trust, and power, contracts and information sharing. A brief example from the retail distribution industry is used to illustrate the role of the governance mechanisms of contract, power and different types of trust in information and material flow coordination. The paper concludes with a discussion of the framework and plans for future research.

SUPPLY CHAIN AS A BUSINESS MODEL

Although the concept of a supply chain is not new, it is only recently that companies have successfully harnessed information technology to coordinate activities that enable them to compete at the chain level. Consider a supply chain to be a set of three or more organizations which are directly linked to support the flow of products, services, finances and information from a source to a customer (Huang and Gangopadhyay, 2004). At each step in the supply chain, a flow of real time information is necessary to enable coordination so that the chain attains optimal performance. Sharing of real-time partner-specific data enables more accurate planning. This increases capacity utilization, for example, as business partners know where resources lie idle and where they are overloaded. Because of the transparency of information in the chain, risks can be shared among participating partners. Improvements in coordination should result in increased total profit of the chain, again resulting in revenue increases for chain members. Thus, this view raises the level of analysis of a business model to cover the collective set of organizations within the chain, linked together as a series of actors, products and services, information flows, and collective benefits within a common revenue stream (Timmers, 1998).

SUPPLY CHAIN COORDINATION

Supply chain coordination plays a key role in this new business model. Performance of the supply chain depends largely on efficient coordination of the activities of the chain members or partners (Simatupang et al., 2002). Coordination is needed to assure the timely flow of information and materials. To succeed in information sharing, firms need to agree on common governance mechanisms (which we call 'enablers') to manage the flow of information and materials. We consider three enablers that aid interorganizational coordination and information sharing. They are bargaining power, contracts and trust (Alvarez et al., 2003). Each of these governance mechanisms will be discussed in more detail as part of the presentation of the coordination framework in Figure 1. The outcome of coordination and performance leads to feedback or collective learning in the chain in a multi-period setting.

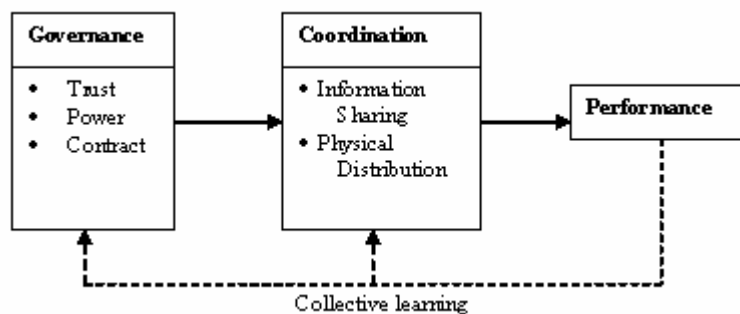


Figure 1. Framework for governance mechanism, coordination and performance of a supply chain

Performance

Performance describes the outcome of any business initiative. Performance measurement should be both at the individual partner and the chain level. Supply chain performance is normally looked at from an operational perspective (Gunasekaran, Patel and Tirtiroglu, 2001), business process perspective (Hoek, 2001), and financial perspective (Beamon, 1999). Beamon (1999) has analyzed existing performance measures and subsequently identified twelve categories of measures, broadly grouping them under three headings – resource, output, and flexibility measures. Resource measures look at performance of the chain in terms of inventory levels, personnel requirements, equipment utilization, energy usage and cost. Output measures include customer responsiveness, quality and the quantity of final product produced. Flexibility measures study volume,

delivery, mix and new product flexibility. While the resource and output measures reflect performance of the chain, the flexibility measures throw light on the chain's capacity to coordinate and gain success under changing situations, and are thus considered as a component of coordination in our framework.

Coordination

Effective performance relies upon efficient and effective coordination within the chain. Coordination is the act of properly combining a number of elements (actions, objectives, decisions, information, knowledge, funds) for the achievement of the chain goal (Simatupang et al., 2002). Coordination is required to manage risk, achieve optimal performance and maximize profitability across the chain. Inefficient coordination leads to lower performance in terms of high inventory cost, longer delivery time, higher transportation cost, higher levels of loss and damage, and lowered customer service (Lee et al., 1997). Coordination is needed in two areas: material flows and information sharing. Material flows can be measured by the flexibility measures outlined above. Information sharing, the coordination component we focus on in this paper, is discussed in more detail in the next section.

Information Sharing

Information sharing may improve chain performance by reducing slack, stockouts, safety stocks, inventory levels, and the like. To enable this, shared information must have certain attributes that make them valuable. These attributes are primarily: usefulness, timeliness, durability, reliability and level of aggregation (King and Epstein, 1983; DeMaagd, 1984; Davis, 1989; Laband, 1989; Lee, Strong, Kahn and Wang, 2002). We now examine these.

- *Usefulness*: Usefulness is the degree to which a chain member believes that using a particular information will enhance job performance. Intention by a chain member to use information shared by other chain members is conditioned primarily by its perceived usefulness and ease of use.
- *Timeliness*: This refers to up-to-date information, data captured at source and transmitted real time, permitting immediate exception reporting and enabling chain members to be proactive rather than reactive.
- *Durability*: Information value decays over time. Firms in the chain can delay those kinds of information that are more durable, experiencing low variance and are therefore less important for immediate decision making. Durable information can serve as a base on which quick response is carried out.
- *Reliability*: Unreliable information, if acted upon without verification, may create problems in coordination and chain performance. Exceptional data (exception reporting) is one element that may be reliable and thus require immediate attention.
- *Level of Aggregation*: When data is too detailed, general or inappropriately categorized, its usefulness diminishes. This calls for appropriate aggregation. Care should be taken that while aggregating, the information being aggregated should retain value, breadth and depth required for the task for which it is being aggregated.

Coordination can assist in chain-wide risk-sharing among participants, but it can also increase risks for individual companies that could be harmed by losing control over valuable information or relying on poor information sharing. Companies may become vulnerable to risk for many reasons. This calls for governance mechanisms to manage relationships. We focus our study on three of these, trust, bargaining power and contracts, each of which (or lack thereof) can work to increase or decrease risk, coordination quality, and ultimately, company performance.

Trust

Trust, from the viewpoint of partners within the supply chain, increases confidence of one party that the other party in a two-way relationship will not exploit its vulnerabilities (Sako 1991; Svensson 2001).

Trust is frequently cited as a reason why partnerships may not be seen as working as well as they should (Sahay, 2003). The presence of trust in business relationships has many advantages. Trust is associated with lower ex-post transaction costs between buyer and the supplier (Dyer and Chu, 2003). Supplier investment in specialized equipment, adaptation of the production process, and information sharing are eased (Sahay, 2003). High levels of trust in the channel relationship also lead to high levels of buyer satisfaction (Andaleeb, 1996).

Trust is one of very few constructs that can apply equally to individuals, groups of individuals, companies, industry groups, political entities, and supply chains. For our purposes, we focus on organizational-level trust as it is perceived by individual companies with respect to their immediate business partners in the chain. We also, for our study, consider trust among supply chain members to be of the semi-strong form, as a situation of 'no vulnerability' (weak form trust) and partners adhering to strict ethical principles and standards (strong form trust) is rarely found in actual business practice (Barney and Hansen, 1994).

A review of the literature on trust provides insights on different types of organizational-level trust (Komiak and Benbasat 2004; Paul and McDaniel, 2004). They include calculative, competence (Newell and Swan, 2000), relational, benevolence, trust in integrity, trust in predictability, trust in credibility, contractual (Komiak and Benbasat, 2004), goodwill (Sako, 1991), deterrence-based, knowledge-based (Sheppard and Tuchinsky, 1996).

Benevolence and goodwill trust are related to the urge to do good to the other party regardless of own profits. Integrity and credibility trust connote the idea of good faith and fulfillment of promises. Resilient trust is the reliance in the integrity of the other person on whom the first party depends (Ring, 1996). This can be related to trust in integrity. Deterrence and calculative trust relate to analysis of the costs and benefits of staying in a relationship. Knowledge-based and predictability trust are similar – the knowledge and ability to predict what the other partner will do in a given situation.

We consider the following five types of trust for our study. These are chosen because of their potential for explaining organizational-level performance impacts and coordination differences within supply chain relationships.

- *Calculative Trust:* The decision to enter into a business relationship is based on a calculation of the benefits and costs of entering the relationship. Calculative trust is an ongoing, market-oriented, economic calculation where each party assesses the benefits and costs to be derived from creating and sustaining a relationship.
- *Competence Trust:* This refers to the ability of a party to perform a task that it says it can perform and covers technical, operational, human and financial abilities. Competence trust is required in complexity-reducing collaborative efforts when the skills needed to perform a task are not found within one partner.
- *Trust in Integrity:* Trust in integrity is the belief that a trustee makes good faith agreements, tells the truth and fulfils promises. It is the trustor's perception that the trustee follows sets of principles that the trustor finds acceptable. It is more important in supply chain because of the presence of numerous players.
- *Trust in Predictability:* This is the trustor's belief that a trustee's actions (good or bad) are consistent enough that the trustor can forecast them in a given situation.
- *Contractual trust:* A written contract is the first step to objective fulfillment. The second is the adherence in a timely manner to achieve the desired result. This trust, arising out of the existence of a legal contract is the trustor's belief that a trustee is honest and fulfills the explicit and implicit requirements of the contractual agreement.

Contracts

Contracts, as a governance mechanism, are designed to attain two main objectives: (i) increase total profit of the chain and (ii) share the risks among the chain partners (Giannoccaro and Pontrandolfo, 2004). Since multiple organizations are involved, each pursuing their independent and sometimes conflicting objectives, legal, written contracts provide a means to enforce coordination. While designing a contract, a win-win situation is sought by both parties so that every player in the chain earns a profit higher than it would earn without the contract. Otherwise, a supply chain member is unlikely to adopt the contract (Giannoccaro and Pontrandolfo, 2004).

A formal, legal contract is essential to allay the risks and vulnerabilities of a business. Trust does not preclude reliance on a contract (Alvarez et al., 2003). The contract can be seen as a way of imposing trust among the parties in an interaction.

Bargaining Power

In a supply chain, when a channel member controls resources another channel member wants or needs, it acquires power which enables it to exert influence over other members in the chain or in a dyadic relationship (Andaleeb, 1996). Bargaining power not only stems from the control of critical resources, but also from control of critical processes, the reach of the partnering firm in total value added to the product and, the relative size of the partner. Because of the presence of bargaining

power, many small and medium manufacturers of end-products are reluctant to have a large player in the incoming material or outgoing finished product chain who can 'stifle' the chain.

Collective Learning

The outcomes of coordination and performance lead to feedback or collective learning among participants in the supply chain. Members learn from the mistakes committed by themselves or others, from opportunities lost due to negligence, or from inadequate information sharing. Collective learning also lead to new innovations in processes, methods of operations and new product development (Simatupang et al., 2002). We look at supply chain as a multi-period activity and consider learning in one cycle as a feedback mechanism that help to find deficiencies in information sharing and physical distribution flows; and affects the role that trust, power and contracts will play in the next cycle or period.

Interrelationship among trust, power and contract

The governance mechanisms of trust, power and contract are not mutually exclusive, but influence and are influenced by each other. When trust is limited between the parties, contractual agreements are commonly established to enhance their legal obligations. Over a period of time, this helps to build trust (Handfield and Bechtel, 2002). But this does not mean that contract is always the precursor to trust. Even in an ongoing relationship, when there is solid foundation for trust, the parties will refer to a contract to test the fundamental principles on which the relationship is based (Foorman, 1997).

Bargaining power influences trust. In a situation where more than one supplier exists, buyers may trust a supplier less due to the fact that the supplier is the only source in the market for a unique product or service, and may resort to power tactics (Handfield and Bechtel, 2002). However, if power is exercised, it may have a negative impact on trust (Dyer and Chu, 2003).

When the supplier has more power, the buyer will depend more on a formal contract. Handfield and Bechtel (2002), in a study of purchasing managers in North American manufacturing firms, showed that buyers used strong formal contracts to safeguard themselves from strong suppliers.

Trust is a key governance mechanism, which is shaped by and works with contracts and bargaining power to determine the extent of success achieved by information sharing and material flows in the supply chain.

THE ROLE OF TRUST

While figure 1 relates supply chain governance mechanisms to performance, we focus the remaining discussion in this paper on the portion of the figure 1 framework that links trust with the other components of governance and with information sharing. This is recreated and emphasized in figure 2 and forms the focus of our study. We present three research questions that guide our study of trust:

- How does the existence or contents of contracts affect trust?
- How do differences in power relationships affect trust?
- How does trust influence coordination through information sharing?

Figure 2 depicts the portion of the framework that reflects these research questions, and includes the factors we have identified in the literature review as relevant to each of these constructs.

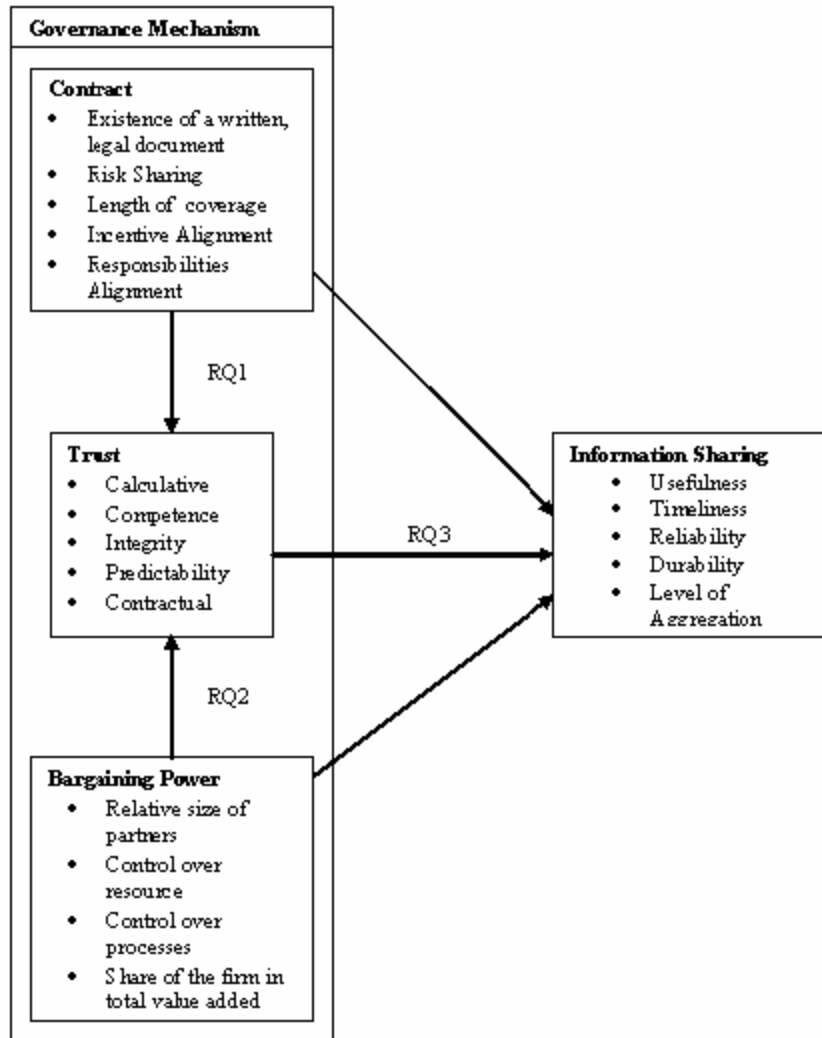


Figure 2. Framework for the role of governance in supply chain coordination

Next, we present a brief summary of our field research that illustrates the issues raised by these research questions.

AN ILLUSTRATION

As part of a large-scale research project¹ in which five multi-organizational case studies form the basis of cross-case analysis of factors influencing interorganizational information sharing relationships, we conducted interviews with 30 individuals at a major retailer, and with several representatives from two of their major suppliers (hereafter S1 and S2). These trading partners are engaged in a buyer-supplier relationship to exchange order and/or sales forecasts following the procedures and standards of Collaborative Planning, Forecasting and Replenishment (CPFR) process². They collaborate on demand forecasts to improve order fulfillment, reduce standing inventory, and prevent stockouts. The suppliers interact with systems operated by the retailer.

¹ See www.bentleyinvision.org for an overview of the project.

² See www.vics.org for more information on CPFR.

The retailer conducts the CPFR process with only a handful of its hundreds of vendors, on less than 20% of its stock-keeping units (SKUs). Information sharing is conducted for high volume and high value SKUs where perceptions of durability and usefulness of sales and order forecasts are perceived to justify the cost of the interaction.

Relationships differ across each trading partner dyad. In their simpler information sharing scenario, which they call “CPFR Lite”, the retailer uploads sales forecasts sixteen weeks out to the CPFR system on around 350 SKUs each, for the two suppliers. In the more involved coordination effort (CPFR-Heavy), covering 50 items of S1 and 30 items of S2, both the retailer and suppliers upload their sales forecast data along with order forecasts for some of these items for S2. A weekly discussion between the retailer and suppliers focuses on variances between the two sets of forecasts and actual orders.

The information sharing relationship between the retailer and the suppliers has helped to build up trust over time. A manager in charge of demand planning at S2 noted that there was both data sharing and increased personal communication between individual counterparts at the two companies, as well as increased communication among internal employees whose productivity also benefit from increased information sharing. This observation points to the presence of calculative, competence, integrity and predictability trust. Both parties agree that information sharing is useful to them. Because they discuss any differences between their two sets of forecasts, predictability is enhanced and a perception of partner competence is created. The presence of committed order forecasts improves perceptions of integrity among the partners as well.

These suppliers also share information with other retailers. In speaking of another trading partner dyad, an EDI manager at S1 described a turning point at which one of their customers finally agreed to share forecasts with them after being shown what the process and its benefits might achieve. The client displayed calculative trust by assessing the benefits and costs to be derived from the relationship.

The retailer shares order forecast data with S2 for a set of items which reflect either a significant part of their trading relationship or irregular ordering patterns. The cost of producing order forecasts for this set of items is perceived to be offset by the benefits of an improved ordering relationship, again demonstrating calculative trust.

S1 does not currently have a legal contract with the retailer. They chose not to enter into a legal contract because the retailer refused to commit to order forecasts with sufficient lead time to offset the retailer’s contractual fulfillment rate. S2 has a front-end agreement that governs the relationship of sharing point of sales (POS) and other forecast data. The formal contract has enabled better information sharing among this dyad, and they have realized a secondary benefit of improved sales relationship management.

The same manager from S2 was well aware of the sizeable impact of significant differences between forecasted orders and actual demand arising from any single large customer. Because the retailer we studied is a very large customer, these suppliers cannot afford to jeopardize the relationship by demanding more “useful” order forecasts for a greater number of SKUs.

These few examples from interviewees give a snapshot of the importance of trust in sharing information with business partners. Trust is difficult to separate from the related governance mechanisms of power and contracts. All three will affect the nature of information sharing relationships, as well as the usefulness and quality of the shared information. As we further explore the answers to the three research questions we have proposed, we expect to discover linkages among specific types of trust and the factors or properties inherent in the power, contracts and information sharing constructs.

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

The trade press is replete with stories of permeable organizational boundaries that have resulted from an increase in information sharing and material flow coordination. Business processes now routinely operate across organizational borders, and previously guarded information is made visible to a multitude of business partners. While information technology serves as an enabler for this sharing to take place, successful deployment of interorganizational coordination efforts within a supply chain depends upon the existence of a cohesive set of governance mechanisms that can be clearly linked to performance and process improvements.

In this paper, we have argued that power, trust and contracts comprise the set of governance mechanisms that enable the information sharing and material flows of a successful coordination relationship. We describe the factors or properties of

each of these constructs, and propose a framework demonstrating the linkages among them. We briefly summarize an example of the importance of the constructs within the retail industry.

While the contribution of this paper is in constructing a model of the relationships among the governance, coordination and performance of the supply chain business model, the true test of the framework remains to be documented. Our future research plans involve conducting a more formal and comprehensive analysis of the interview data collected in the three organizations involved in this case study. This exploratory analysis will form the basis of a more comprehensive project in which over ninety suppliers within a large industry base will be surveyed to test hypotheses concerning the factors found to contribute most directly to supply chain integration and success. The ultimate goal of the research is to substantiate and support the model proposed in Figure 1, and to propose guidelines for optimal supply chain operations.

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