Supply Chain Coordination and Cooperation Mechanisms: An Attribute-Based Approach

AUTHORS

Lei Xu

is a Ph.D. candidate in the department of statistics at the University of Washington in Seattle, Washington.

Benita M. Beamon

is an assistant professor of industrial engineering at the University of Washington in Seattle, Washington.

SUMMARY

Coordination within a supply chain is a strategic response to the problems that arise from inter-organizational dependencies within the chain. A coordination mechanism is a set of methods used to manage interdependence between organizations. Given the increasing importance of high-performance supply, and the advantages to be gained through supply chain coordination, the challenge to an organization is how to select the appropriate coordination mechanism to manage organizational interdependencies. This paper develops and illustrates an attribute-based, systematic process for selecting coordination mechanisms in a supply chain.

The Journal of Supply Chain Management: A Global Review of Purchasing and Supply

INTRODUCTION

A supply chain consists of many organizations acting together, with each organization dependent on the performance of other organizations in the chain. Coordination within a supply chain is a strategic response to the challenges that arise from these dependencies. A coordination mechanism is a set of methods used to manage interdependence between organizations. By definition, there are a number of different people, entities, and processes that interact in order to execute supply chain objectives. Coordination mechanisms, then, provide tools for effectively managing these interactions.

The importance of coordination cannot be overemphasized. Indeed, supply chain management (SCM) is commonly defined based on coordination: "SCM is the planning and coordination of activities, from procurement to production, through . . . distribution" (Arunachalam, Sadeh, Eriksson, Finne and Janson 2003). As time-based competition increases, in part due to e-commerce, the Internet, and improved information systems, there are greater pressures for organizations to improve response times. Arunachalam et al. (2003) also observes the importance of corporations forming alliances in order to best exploit market conditions and improve competitiveness. Given the increasing importance of high-performance (rapid response, high quality) supply, and the advantages to be gained through supply chain coordination, the challenge to an organization is how to select the appropriate coordination mechanism.

Coordination mechanisms may be differentiated on the bases of four attributes: resource sharing structure, decision style, level of control, and risk/reward sharing. Given that the selection of a coordination mechanism is often based on minimizing relative costs, transaction cost theory (TCT) can be used to classify the three types of costs associated with coordination: coordination cost, operational risk cost, and opportunistic risk cost. This facilitates relating each coordination mechanism attribute to a type of cost. Finally, organizations do not operate in a vacuum. The environment in which an organization operates will

influence the coordination mechanism selected. Three environmental factors will be considered: the interdependence between organizations, uncertainty, and information technology. Moreover, the objective of this work is to develop a framework that enables organizations to select appropriate coordination mechanisms, based on relative costs and the characteristics of their specific operating environment.

BACKGROUND

This section provides background on previous work in general dependency classifications and specific supply chain dependencies.

Dependencies Between Actors and Dependencies Between Activities

Traditionally, dependency is classified as either arising between organizations (actor-to-actor dependencies) or between activities. For actor-to-actor dependencies, the research describes different patterns of interdependence between organizations and discusses coordination based on the type of interdependence. Thompson (1967) is representative of early work in this area. The author identifies different coordination mechanisms that are used to respond to different levels of interdependencies between organizations, and categorizes these interdependencies as pooled, sequential, or reciprocal (listed in order of increasing strength of interdependency). Corresponding to each kind of interdependence, Thompson (1967) identifies three kinds of coordination mechanisms: standardization, plan, and mutual adjustment. Van de Ven, Delbecq and Koeing (1976) extends the Thompson framework by adding a fourth type of interdependency: team arrangement, in which partners work jointly and simultaneously. In their research, the authors identify three kinds of coordination mechanisms — impersonal (plans and rules), personal (vertical supervision), and group (formal and informal meetings) — and observe that as the level of interdependence increases (from pooled to team arrangement), so too does the need for group coordination.

Viewing dependency as a relationship between activities originated in the field of artificial intelligence. From this perspective, coordination is defined as a "process of managing dependencies between activities" (Malone and Crowston 1994). This alternative perspective led to a new set of coordination mechanisms defined by dependencies between activities.

Dependencies and the Supply Chain

Dependency theories were first applied to SCM in the 1990s. In addition to interdependency, later work attempted to identify other factors related to coordination mechanisms. For example, Nassimbeni (1998) maps different network structures to different interdependencies and identifies different coordination mechanisms for each kind of supply chain network structure. Simatupang, Wright and Sridharan (2002) use a similar approach. The authors define coordination mechanisms along two dimensions: the focus of coordination (operational or organizational linkages) and the mutuality of coordination (complementary or coherency), which results in four coordination modes: logistics synchronization, information sharing, incentive alignment, and collective learning. Finally, they relate these modes to supply chain performance. More recent work in supply chain coordination focuses on quantitative models for revenue sharing (Giannoccaro and Pontrandolfo 2004; Cachon and Lariviere 2005) and decision-support models for specialized systems (Boyaci and Gallego 2004; Wang and Benaroch 2004; and Xiao, Yu, Sheng and Xia 2005).

For each type of dependency, there are many coordination mechanisms available. Coordination theory does not generally provide guidance for selecting coordination mechanisms, nor does it consider the operating environment of the organization. The objective of this paper is to define a framework for selecting the appropriate coordination mechanism, based on coordination mechanism attributes, costs, and organizational operating environment.

COORDINATION MECHANISM ATTRIBUTES

McCann and Galbraith (1981) analyze coordination strategies on the bases of three dimensions: formality (from informal personal meetings to more formal arrangements), level of control, and decision localization (centralized or decentralized). According to the authors, an increase in dependency will cause an increase in formality, level of control, and centrality. Malone (1987) points out that there are two attributes associated with different coordination structures: information structure (how members share, perceive, and communicate information) and decision function (how members decide what actions to take). Within the decision function, there are two classes: centralized and decentralized. Another important dimension to consider in supply chain coordination, where risks and benefits define the need for coordination, is how to allocate the benefits arising from coordination and which parties absorb the risks. Each organization seeks to implement coordination mechanisms that increase benefits and reduce risk. So, the allocation of risks and benefits strongly influences the organization's action. A framework utilizing four attributes will be used to differentiate the various coordination mechanisms: resource sharing structure, decision style, level of control, and risk/reward sharing.

Resource Sharing Structure

Malone (1987) limits consideration to information sharing. However, since there are other resources to be

shared and communicated within the context of coordination, this dimension is extended to include all of the resources shared. This dimension is defined as resource sharing structure, and follows the classification given in Varamaki and Vesalainen (2003):

- No resource sharing.
- Operational resource sharing, such as communications between operational levels, sharing operational information such as point-of-sale (POS) data, or pooling operational resources in-group problem solving.
- Tactical resource sharing, such as communication between managers in the same function from different firms to achieve consistency or jointly developing inventory and production plans.
- Strategic resource sharing, such as forming strategic alliances, forming strategic level meeting, jointly creating strategic plans, sharing strategic information, or jointly investing resources to make strategic advances, especially in the area of research and development (R&D).

Decision Style

For the decision function, there are two main styles: centralized and decentralized. For the centralized decision style, one firm has primary control. For the decentralized style, each firm makes its decisions autonomously.

Level of Control

Control has two levels: high and low. A high level of control corresponds to strict activity monitoring and control. In this case, the coordinating firms develop detailed and strict rules, routines, and monitoring systems to control other firms' behavior, for the purpose of detecting opportunistic risk. A low level of control corresponds to little to no monitoring and control.

Risk/Reward Sharing

Risk/reward sharing describes the characteristics of the selected incentive system. There are two main types of sharing methods: fair and unfair. A fair condition occurs when one firm undertakes more risk than do other firms in the relationship, but receives more benefits from the coordination. An unfair condition arises when one firm undertakes less risk but enjoys greater benefits, or when one firm undertakes greater risk with fewer benefits.

TCT AND COORDINATION MECHANISMS

Selecting coordination mechanisms can be thought of as a way to implement a particular organizational pattern (Martinez and Jarillo 1989). So, the process of selecting a coordination mechanism is one type of organizational decision activity. Transaction cost theory (TCT) is used to evaluate supply chain coordination mechanisms.

TCT studies the trade-off between transaction costs and production costs. Traditionally, when TCT is applied to manufacturing, only production costs are considered. However, when TCT is applied to supply chains, there are additional types of costs to be considered (such as distribution costs and inventory costs). So "production costs" will be redefined here as costs relative to physical flow, including production costs, new product development costs, distribution costs, inventory costs, and stock-out costs.

Operational Risk Cost

Operational risk cost is the cost arising from unsatisfactory partner performance. There are two main sources of operational risk cost (Wathne and Heide 2000):

- Shirking: the costs that arise when a partner shirks responsibilities. For example, a shirking cost is incurred when a supplier ships products that do not satisfy required quality specifications.
- Refusal to adapt: the costs due to suppliers failing to adapt to changing environments. For example, a refusal to adapt cost is incurred when the demand for a product changes, but the supplier refuses to change the supply quantity.

In some cases, it may be advantageous to institute contractual penalty clauses, which helps to mitigate operational risk.

Opportunistic Risk Cost

Opportunistic risk cost is the cost associated with a lack of bargaining power or a loss of bargaining power stemming directly from the execution of a relationship. There are two main sources of opportunistic risk cost:

- Power asymmetries: When a small supplier negotiates with a more powerful firm, then the more powerful firm is in the position to command the most benefits.
- Loss of resource control: New partners will acquire new technology and pose a competitive threat to the original partner.

Coordination Cost

Coordination costs are those associated with physical flow and the direct costs of managing the coordination.

Therefore, when a firm selects a coordination mechanism with a partner, the firm bases its selection on the trade-off among three types of costs: coordination costs, operational risk costs, and opportunistic risk costs. Firms seek to select the coordination mechanism that minimizes the total cost.

The next task is to study the cost implications of the four coordination mechanism attributes from the Coordinates Mechanism Attributes section:

1. **Resource Sharing Structure:** Generally, a higher level of resource sharing reduces the costs associated with physical flow, but increases the risk costs.
2. **Decision Style:** For a centralized decision style, since a single firm is in control, there is less need for negotiation and communication, resulting in reduced coordination costs. However, with the centralized decision style, the controlling firm can exploit its power to gain more benefits, but with higher opportunistic risk costs. For a decentralized decision style, it is more difficult to achieve agreement, which yields increased coordination costs, but likely lower risk costs.
3. **Level of Control:** Generally, as control increases, the coordination costs increase, while risk costs decrease. For a low level of control, the coordination costs will decrease, but the risk costs will increase.
4. **Risk/Reward Allocation:** For the unfair case, the firm with greater benefits has no financial motivation to leave the coordination partnership; thus the risk cost is small. However, the firm with fewer benefits may be motivated to exploit the coordination in order to achieve greater benefits, which increases the risk cost.

Table I summarizes the relative costs associated with each coordination mechanism attribute.

OPERATING ENVIRONMENT

This section explores the influence of a firm's operating environment on coordination mechanism selection. The exploration begins by relating the operating environment to the three types of costs (coordination, opportunistic risk and operational risk), and considering the following three factors associated with a firm's operating environment: interdependence between organizations, uncertainty, and information technology.

Interdependence

Evaluating coordination is dependent on its relative costs: transaction costs and costs relative to physical flows. According to TCT, there are two main factors that influence transaction costs (Williamson 1975, 1985): (1) uncertainty and (2) asset specificity (transaction-specific investments that include human or physical assets invested in a particular relationship, which have little value outside of the specific relationship).

Heide (1994) argues that transaction-specific assets constitute dependence, since the existence of a specific asset makes the replacement of partners costly. For example, if a manufacturer invests in supplier training, then the manufacturer may find it difficult (costly) to later replace the (trained) suppliers. Since specific assets constitute dependency, and coordination is defined as a response to dependency, the more general term "interdependence" will be used here (instead of asset specificity) as a factor.

Interdependence is a precursor to coordination, since without interdependence there is no need for coordination.

Table I

COORDINATION MECHANISM ATTRIBUTES VERSUS RELATIVE COST

	Coordination Cost	Opportunistic Risk Cost	Operational Risk Cost
Resource Sharing Structure			
No Sharing	High	Low	Low
Operational Resource	Medium	Medium	Medium
Tactical Resource	Medium	High	Medium
Strategic Resource	Low	High	High
Risk and Reward Sharing			
Fair	Medium	Medium	Medium
Unfair	High	High for the firms who receive greater benefits, low for others	High for the firms who receive greater benefits, low for others
Decision Style			
Centralized	Low	High	High
Decentralized	High	Low	Low
Level of Control			
High	High	Low	Low
Low	Low	High	High

Heide (1994) and Frazier (1999) define two primary attributes of organizational interdependence:

1. Level of interdependence: The degree of one organization's potential for influence on the other organization's beliefs, attitudes, and behaviors. Here, only high interdependence levels need to be considered, in which one firm has a significant influence on other organizations (recall, low levels of interdependence do not require coordination).
   Interdependence is symmetric: The organizations have approximately the same degree of influence on the other organizations' belief, attitudes, and behaviors.
   In order to describe the interdependence relationship in more detail, a concept from game theory will be applied (generally, game theory is a method for analyzing strategic behavior between at least two players, when the two players interact, are in conflict, and whose actions affect one another).
2. Preference structure: Preference structure consists of two main classes: cooperative and competitive. Cooperative describes a ''win–win'' situation. Competitive refers to the situation in which one firm's benefits are obtained at the expense of the other firm's benefits.

Therefore, there are two dimensions to describe firms with a high level of interdependence: symmetric versus asymmetric and cooperative versus competitive. In the asymmetric interdependent situation, the less dependent firm will have the power to develop rules and exert authority. Therefore, the more powerful firm can select the coordination mechanism to exploit its asymmetric power to maximize its own benefits, which results in higher risk costs for the less powerful firm. In the case of symmetric interdependence, coordination mechanism selection is a mutual adjustment process in which each firm faces nearly identical risk costs. For cooperative interdependence, the two firms can create a win–win situation, which would provide less motivation to violate established rules. In this case, the risk costs will be low. In the competitive interdependent situation, each firm will achieve benefits at the expense of the other firm's benefits. In this case, the risk costs will be much higher and consistency will be much more difficult to achieve, which will lead to higher coordination costs.

Uncertainty

There are two types of uncertainty: environmental uncertainty and behavioral uncertainty. Environment uncertainty refers to ''unanticipated changes in circumstances surrounding an exchange'' (Noordewier, John and Nevin 1990). Behavioral uncertainty arises when it becomes difficult to evaluate whether or not a firm's actions will adhere to contractual rules. Higher uncertainty will result in higher costs for physical flow and higher (particularly operational) risk costs.

Information Technology

Malone and Crowston (1994) suggest that development of information technology (IT) reduces communication costs, thus reducing transaction costs. For example, Carr and Smeltzer (2002) illustrate that with the development of IT, buyer–supplier communication frequency increases. The IT factor characterizes the level of existing information technology employed in the firm, for example, the use of enterprise resource planning (ERP) or electronic data interchange (EDI). According to empirical studies, IT can significantly reduce coordination costs, especially communication costs. Clemons and Row (1992) and Clemons, Reddi and Row (1993) found that:

- IT reduces coordination costs.
- IT lowers operations risk (improved monitoring and incentives).
- IT reduces opportunistic risk.

A summary of the operating environment versus relative costs is provided in Table II.

COORDINATION MECHANISM SELECTION

Table III summarizes the results, based on the previous analysis of coordination mechanism attributes, the associated coordination costs, and the operating environment.

Table III depicts the relationship between a firm's operating environment and coordination mechanism selection. One example is the Motorola and In-Focus strategic alliance in the area of high-performance video display panels. In-Focus contributed the low-cost high technology, while Motorola contributed the integrated circuits (www.corporate-partnering.com). Motorola purchased 20 percent interest in In-Focus, giving In-Focus the capital it needed, an important customer, and access to Motorola's distribution system (www.corporate-partnering.com). Motorola received a new customer for its integrated chips and a new technology that it could not develop internally, allowing Motorola to compete with rival Japanese competitors (www.corporate-partnering.com). This partnership would be classified as asymmetric and cooperative, likely resulting in lower relative costs to Motorola (the more powerful firm) than to In-Focus, but clearly beneficial to both. Another example of an effective strategic (also asymmetric and cooperative) alliance is Soho Natural Soda, a start-up company that did not have any money to build, rent, or operate bottling facilities. Soho partnered with a regional beer company to use its excess capacity to bottle Soho's soda, and then entered into a contract with Anheuser-Busch to handle distribution

Table II

OPERATING ENVIRONMENT AND RELATIVE COSTS

	Coordination Cost	Opportunistic Risk Cost	Operational Risk Cost
Interdependence			
Symmetric and Cooperative	Low	Low	Low
Symmetric and Competitive	High	High	High
Asymmetric and Cooperative	Low (powerful firm) Medium (other firms)	Low (powerful firm) Medium (other firms)	Low (powerful firm) Medium (other firms)
Asymmetric and Competitive	Low (powerful firm) High (other firms)	Low (powerful firm) High (other firms)	Low (powerful firm) High (other firms)
Environment Uncertainty			
High	High	High	High
Low	Low	Low	Low
Information Technology			
High	Low	Low	Low
Low	High	High	High

(www.corporate-partnering.com). The regional beer company and Anheuser-Busch received renewable income, while Soho was able to grow its business from just an idea to $11 million in sales (with very little overhead cost) (www.corporate-partnering.com). While these examples demonstrate the potential for effective cooperation and coordination, there is very little available in the literature that helps identify what type of coordination mechanism is appropriate for a given organization or set of organizations.

Table III

COORDINATION MECHANISM SELECTION

	Description
Interdependence	
Symmetric and Cooperative	Facilitates coordination with strategic or tactical resource sharing. Fair risk and reward sharing lead to reduced risk costs. The decision style tends to be decentralized.
Asymmetric and Cooperative	Prefers coordination with operational or no information sharing, since for the less powerful firm, its risk costs will be high. Risk and reward sharing can be unfair, where more powerful firms receive more benefits. The decision style may be centralized, in which the smaller firms will attempt to satisfy the more powerful firm's requirements.
Asymmetric and Competitive	The less dependent firm will have the power to develop rules and exert authority. Therefore, the more powerful firm can select the coordination mechanism to exploit its asymmetric power to maximize its own benefits, which results in higher risk costs for the less powerful firm.
Symmetric and Competitive	No resource sharing.
Environment Uncertainty	
High	A higher level of resource sharing will generate more benefits; however, the risk cost will also be high. The selection will be a trade-off between the benefits and the risk costs. A decentralized decision style will be preferred to reduce the risk cost.
Low	A higher level of resource sharing does not yield significant benefits and will create higher risk costs or coordination costs. Therefore, operational resource sharing or no resource sharing is preferred.
Information Technology	
High	Advanced information technology will greatly reduce the coordination costs and operational risk.
Low	A higher level of resource sharing will yield higher coordination costs. Therefore, a lower level or no resource sharing will be preferred. A lower level of control will also be preferred, which will reduce cost.

Table III can be used to select the appropriate coordination mechanism, according to the following four-step process:

Step 1. Analyze the firm's operating environment on the bases of the three operating environment factors: interdependence between organizations, uncertainty, and information technology.

Step 2. Given the operating environment, use Table III to describe the desired coordination mechanism in terms of the four attributes: resource sharing structure, decision style, level of control, and risk/reward sharing. In certain situations, such as when operating environment characteristics do not clearly fall into one category or another, multiple coordination mechanisms may be appropriate.

Step 3. Generate a list of possible methods to implement the coordination mechanism and its associated attributes.

Step 4. Select the coordination mechanism implementation method from Step 3 that best meets the desired coordination mechanism attributes determined in Step 2.

MANAGERIAL IMPLICATIONS

In this research, the objective is to develop a process that enables supply chain managers to select coordination mechanisms in a supply chain. The process developed in the previous sections is illustrated in this section, followed by managerial implications for implementation. The illustrative example focuses on a retail apparel company (Company A). Company A would like to coordinate with its main supplier (Supplier B) in order to improve performance. The four-step coordination mechanism selection process will be applied to this situation.

Step 1. Perform an analysis of the organization's operating environment in terms of the three operating environment factors: interdependence between organizations, uncertainty, and information technology.

Table IV

EXAMPLE: OPERATING ENVIRONMENT

	Interdependence	Uncertainty	Information Technology
Company A	Symmetric and Cooperative	High	High

- *Interdependence* between Company A and Supplier B: Company A is the main customer of Supplier B. If A increases sales, then B's sales will increase in turn. The interdependence between A and B can be classified as symmetric and cooperative. This type of interdependence can help to reduce the risk cost.
- *Uncertainty*: The demand in the apparel industry is unpredictable. Given the high degree of uncertainty, the risk cost will be relatively high.
- *Information Technology*: Company A and Supplier B currently use compatible ERP systems, and both have broadband Internet connectivity. Therefore coordination costs should be relatively low.

Company A's operating environment is summarized in Table IV.

Step 2. Using the characteristics of Company A's operating environment in conjunction with Table III, the coordination mechanism can be described on the bases of the four attributes: resource sharing structure, decision style, level of control, and risk/reward allocation. The results are:

- *Resource Sharing Structure:*
  Higher level of resource sharing, strategic or tactical, such as sharing production planning data or apparel design information.
- *Decision Style:*
  Decentralized decision style. The two firms will make decisions independently. However, they may share information used in decision making.
- *Level of Control:*
  Medium. Coordination is monitored.
- *Risk/Reward Allocation:*
  Fair. A and B share equally the risks and benefits.

Step 3. Generate a list of possible methods to implement the coordination mechanism and their associated attributes. Company A is considering the following methods:

- Market: Without cooperation, use market pricing for the coordination. Company A will develop a contract with Supplier B. Company A will institute a rigorous inspection protocol for products from Supplier B.
- Quick Response (QR): In this scenario, company A will share demand information with the supplier, and cooperate with the supplier with regard to distribution. However, company A will make the decisions, and will receive greater benefits than the supplier with QR. Company A will institute a moderate (less rigorous) inspection protocol for products from Supplier B.

Table V

EXAMPLE: COORDINATION MECHANISMS

	Resource Sharing Structure	Level of Control	Risk/Reward Sharing	Decision Style
Market	No sharing	High	Fair	Decentralized
QR	Operational	Medium	Unfair	Centralized
SMI	Tactical	Medium	Fair	Decentralized
Strategic Alliances	Strategic	Low	Fair	Decentralized

QR, quick response; SMI, supplier-managed inventory.

- Supplier-Managed Inventory (SMI): By sharing demand, production and inventory information, Supplier B will manage Company A's inventories of Supplier B's products. Company A will institute a moderate inspection protocol for products from Supplier B.
- Strategic Alliance: In addition to cooperating in the logistics function, A will invite B to participate in the production design process, share knowledge and technical skills, and have common staff. Company A will not require inspection.

The summary of the possible methods to implement the coordination mechanism and their associated attributes is illustrated in Table V.

Step 4. Select the coordination mechanism implementation method from Step 3 that best meets the desired coordination mechanism attributes determined in Step 2.

Selecting a Coordination Mechanism: From Steps 2 and 3, SMI is the only coordination mechanism that meets all four of the attribute requirements determined in Step 2. Therefore, SMI is the most appropriate coordination mechanism in this case.

Selecting a coordination mechanism is a tactical-strategic decision. As such, it is intended to govern the medium to long-term coordination structure between organizations. As operating environments change, so too must the corresponding coordination mechanism. Thus, the four-step process must be reexamined periodically (as part of a comprehensive continuous improvement plan) and re-executed when a firm's coordination costs or operating environment change substantially.

SUMMARY AND FUTURE RESEARCH

For an organization within a supply chain, effectively managing dependencies is very important. Indeed, as market pressures dictate that today's commercial supply chains provide rapid and efficient supply, the need to coordinate with all organizations within the supply chain is becoming increasingly critical. As such, there is an emerging need for organizations to understand, formalize, and manage the resulting interdependencies. Based on transaction cost theory, a framework for effective coordination mechanism selection was developed. This framework is based on the critical characteristics of the supply chain in question; in particular, the relative costs of physical flow and transactions (including coordination and risk costs) and the operating environment of the organization. By using the proposed framework, organizations can more effectively understand and manage the challenges associated with integrating their supply chain.

In the example presented, most of the attributes were clearly defined. In practice, this is not necessarily true. It is clear, therefore, that more than one coordination mechanism should be implemented for a given organization or a given interdependency, particularly in situations in which one or more attributes do not fit squarely within a single category. Therefore, future work is needed to investigate the appropriate use of multiple coordination mechanisms to manage a single set of dependencies. Additional work is needed to detail characteristics of the specific implementation of a particular type of mechanism. For example, suppose the four-step process results in a recommendation to implement SMI. There are many ways to implement SMI. Future research would specify what other mechanisms, if appropriate, should be implemented in tandem with SMI and determine (by characteristic) how SMI (and any other recommended mechanisms) should be implemented for a given situation.

REFERENCES

Arunachalam, R., N. Sadeh, J. Eriksson, N. Finne and S. Janson. "A Supply Chain Management Game for the Trading Agent Competition," *Electronic Markets*, (13:1), 2003, Available January 24, 2005: http://www.csu.ncsu.edu/faculty/wurman/publications.html.

Boyaci, T. and G. Gallego. "Supply Chain Coordination in a Market with Customer Service Competition," *Production and Operations Management*, (13:1), 2004, pp. 3-22.

Cachon, G.P. and M.A. Lariviere. "Supply Chain Coordination with Revenue-Sharing Contracts: Strengths and Limitations," *Management Science*, (51:1), 2005, pp. 30-44.

Carr, A.S. and L.R. Smeltzer. "The Relationship Between Information Technology Use and Buyer–Supplier Relationships: An Exploratory Analysis of the Buying Firm's Perspective," *IEEE Transactions on Engineering Management*, (49:3), 2002, pp. 293-304.

Clemons, E.K. and M.C. Row. "Information Technology and Industrial Cooperation: The Changing Economics of Coordination and Ownership," *Journal of Management Information Systems*, (9:2), 1992, pp. 9-29.

Clemons, E.K., S.P. Reddi and M.C. Row. "The Impact of Information Technology on the Organization of Economic Activity: The 'Move to the Middle' Hypothesis," *Journal of Management Information Systems*, (10:2), 1993, pp. 9-36.

Frazier, G.L. "Organizing and Managing Channels of Distribution," *Journal of the Academy of Marketing Science*, (27:2), 1999, pp. 226-240.

Giannoccaro, I. and P. Pontrandolfo. "Supply Chain Coordination by Revenue Sharing Contracts," *International Journal of Production Economics*, (89), 2004, pp. 131-139.

Heide, J.B. "Interorganizational Governance in Marketing Channels," *Journal of Marketing*, (58:1), 1994, pp. 71-85.

Malone, T.W. "Modeling Coordination in Organizations and Markets," *Management Science*, (33:10), 1987, pp. 1317-1332.

Malone, T.W. and K. Crowston. "The Interdisciplinary Study of Coordination," *ACM Computing Survey*, (26:1), 1994, pp. 87-119.

Martinez, J.I. and J.C. Jarillo. "The Evolution of Research on Coordination Mechanisms in Multinational Research," *Journal of International Business Studies*, 1989, pp. 489-514.

McCann, J.E. and J.R. Galbraith. "Interdepartmental Relations." In P.C. Nystrom and W.H. Starbuck (Eds.), *The Handbook of Organizational Design*, Vol. 2, Oxford University Press, New York, 1981, pp. 60-84.

Nassimbeni, G. "Network Structures and Co-ordination Mechanism," *International Journal of Operation & Production Management*, (18:6), 1998, pp. 538-554.

Noordewier, T.G., G. John and J.R. Nevin. "Performance Outcomes of Purchasing Arrangements in Industrial Buyer–Vendor Relationships," *Journal of Marketing*, (54:October), 1990, pp. 80-93.

Simatupang, T.M., A.C. Wright and R. Sridharan. "The Knowledge of Coordination for Supply Chain Integration," *Business Process Management Journal*, (8:3), 2002, pp. 289-308.

Thompson, J.D. *Organizations in Action: Social Science Bases of Administrative Theory*, McGraw-Hill, New York, 1967.

Varamaki, E. and J. Vesalainen. "Modelling Different Types of Multilateral Co-operation Between SMEs," *Entrepreneurship and Regional Development*, (15), 2003, pp. 27-47.

Van de Ven, A.H., A.L. Delbecq and R. Koeing. "Determinants of coordination modes within organizations," *American Sociological Review*, (41:April), 1976, pp. 322-338.

Wang, Charles X. and Michel Benaroch. "Supply Chain Coordination in Buyer Centric B2B Electronic Markets," *International Journal of Production Economics*, (92), 2004, pp. 113-124.

Wathne, K.H. and J.B. Heide. "Opportunism in Interfirm Relationships: Forms, Outcomes, and Solutions," *Journal of Marketing*, (64:October), 2000, pp. 36-51.

Williamson, O.E. *Markets and Hierarchies*, The Free Press, New York, 1975.

Williamson, O.E. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, The Free Press, New York, 1985.

www.corporate-partnering.com (available May 24, 2005). "Strategic Alliances Partnering Examples."

Xiao, T., G. Yu, Z. Sheng and Y. Xia. "Coordination of a Supply Chain with One Manufacturer and Two Retailers Under Demand Promotion and Disruption Management Decisions," *Annals of Operations Research*, (135), 2005, pp. 87-109.