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How CIOs Can Align IT Capabilities for Supply Chain Relationships^{1,2}

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Executive Summary

Despite continued rapid growth in the outsourcing of supply chain services, long-term relationships between vendors and customers are challenged by the need to create sustainable value from the relationship. Our research suggests that the ability of client firms to align their collaboration modes and IT capabilities with their objectives for the vendor relationship is critical for creating value from supply chain relationships. In this article, we describe four collaboration modes being used for supply chain relationships, how they are aligned with value creation objectives, and the IT capabilities needed to achieve them. Our findings are based on a survey of a major supply chain vendor and 238 of its long-term customers, as well as interviews with IT and business executives responsible for over 100 long-term relationships.

THE IT ALIGNMENT IMPERATIVE IN SUPPLY CHAIN RELATIONSHIPS

External relationships are a key resource for organizations to improve the efficiency and quality of operations, and to develop and market innovations. As IT outsourcing has grown, firms have built “value nets” through a portfolio of sourcing agreements and alliances to realize benefits from external relationships.³ These external relationships can range from short-term to long-term and from arms-length to strategic collaboration, but all depend on IT-enabled collaboration. The ability to exploit IT capabilities⁴ to create business value from these relationships requires the alignment of the relationship objectives, the collaboration mode, and the digital capabilities of the firm. Furthermore, these dimensions will need to be re-aligned as the relationship transitions to a different collaboration mode.

For this study, we focused on alignment in the context of logistics and supply chain services, as this is a core business process and offers rich opportunities for IT-enabled collaboration between vendors and customers.⁵ Traditionally, the governance of such relationships has been focused on price, not on value. Supply chain service providers have segmented customers based on business volume, and customers have rated providers on their ability to deliver reliable and quality service at the lowest cost. A focus on price is appropriate for delivering a commodity service but leaves little room for providers and customers to collaborate to create value. Today, however, advances in IT (e.g., interorganizational process standards, radio frequency

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² We thank the senior editor, the editor-in-chief, Carol Brown, and two anonymous reviewers for their valuable suggestions to improve the article. We are grateful to Richard Welke and Lars Mathiassen at the Center for Process Innovation, Georgia State University, for their constructive comments. We also thank the executives at the vendor and customer firms who provided us with access to data and for their valuable time and insights.

³ For a discussion on the strategic role of value nets and the different modes of their governance, see Rai, A., Sambamurthy, V., and Agarwal, A. “How CIOs Can Enable Governance of Value Nets,” *MIS Quarterly Executive* (7:4), 2008, pp. 113-124.

⁴ We define IT capability as the ability of a firm to digitally collaborate with its external partners.

⁵ For a detailed discussion of the impact of IT capabilities on supply chain processes, see Rai, A., Patnayakuni, R., and Seth, N. “Firm Performance Impacts of Digitally Enabled Supply Chain Integration Capabilities,” *MIS Quarterly* (30:2), 2006, pp. 225-246.

Figure 1: Collaboration Modes in Supply Chain Relationships

Characteristics of Shared Knowledge								
	Business Opportunity		Focus		Payoff Risk		Process Scope	
Mode	<i>Existing</i>	<i>New</i>	<i>Short Term</i>	<i>Long Term</i>	<i>Low</i>	<i>High</i>	<i>Narrow</i>	<i>Broad</i>
Price-only								
Exploitation	○		○		○		○	
Exploration		●		●		●		●
Dual	○	●	○	●	○	●	○	●

Note: ○ *Exploitative orientation* ● *Explorative orientation*

identification [RFID], and business intelligence) are redefining the role of digital capabilities in supply chain relationships.

As firms explore how to exploit supply chain relationships, CIOs face a core set of issues. They need to understand the alternative collaboration modes used in supply chain relationships and how these modes help firms achieve their performance objectives. And they need to understand the IT capabilities that enable each of the modes.

The findings reported in this article are based on a five-year study of a supply chain services vendor recognized as a leader in the use of IT to collaborate with its customers. This vendor pioneered the digitization of tracking, shipping, and inventory management processes, and uses XML, middleware, and industry standards to integrate these processes across customers in a variety of industries, including hi-tech, automotive, retail, and healthcare. Its customers are constantly challenged to streamline their supply chain operations to reduce costs in the movement of raw materials, work-in-process, and finished goods. They are also constantly seeking ways to innovate their supply chains, to provide agility in sourcing, assembly, distribution, reverse logistics, and value-added services.

We interviewed account managers and IT executives both at the supply chain services vendor and at 100 of its customers, and collected survey data from account managers at 238 customers. Our aim was to understand the nature of collaboration and the IT capabilities that enabled long-term customer relationships. Additional details about our interview and field survey methods can be found in the Appendices.

FOUR COLLABORATION MODES IN SUPPLY CHAIN RELATIONSHIPS

We observed that the kind of knowledge that needed to be shared between the vendor and its customers differed significantly according to the objectives for the relationship:

- Customer relationships focused on new business opportunities, long-term performance, risk-taking initiatives, and the end-to-end supply chain process require *exploratory* knowledge to be shared between the customer and vendor.
- Customer relationships that emphasize existing business opportunities, short-term performance and risk-averse initiatives, and have narrow process scope require *exploitative* knowledge to be shared between the customer and vendor.⁶

We then identified four collaboration modes based on the mix of exploratory and exploitative knowledge that is shared between customers and the vendor. These four modes are summarized in Figure 1 and are described below.

PRICE-ONLY MODE

With the Price-only Mode, relationships are arms-length, market-based interactions are entered into to reduce operational costs, while ensuring an acceptable level of service quality. Because they are not collaborative relationships, there is no need

⁶ To learn more about the concepts of exploration and exploitation, please see March, J. G. "Exploration and Exploitation in Organizational Learning." *Organization Science* (2:1), 1991, pp. 71-87.

for customers to engage in either exploratory or exploitative knowledge sharing. For example, a leading Asian contract manufacturer increased the freight volume that it allocated to its logistics supplier after being offered flexible quantity discounts, as it would not incur unnecessary costs as long as it shipped the agreed minimum volume. Over half of the relationships (53%) we studied were classified as Price-only mode collaboration.

Exploitation Mode

Customers using the Exploitation Mode of collaboration move beyond the purchase of standardized offerings and are looking for increased value in their relationship with the supply chain services vendor. Price is no longer the dominant factor that defines collaboration in the relationship. Exploitation Mode relationships focus on *improvements* that have short-term reward horizons and a low risk of not paying off. Generally, customers focus their value co-creation efforts by sharing knowledge with the vendor about selected or narrow opportunities, rather than a large portion of their supply chain process. For example, a large computing OEM collaborated with its major supply chain vendor to further synchronize operations so that its manufacturing facilities were alerted to raw material shipment delays, and its manufacturing resources were redirected in a timely manner. The Exploitation Mode of collaboration was used in about one-fifth (21%) of the relationships we studied.

Exploration Mode

With the Exploration Mode, customers collaborate with the vendor to discover value streams that are unavailable to it given its current configuration of supply chain capabilities. These customers seek to collaborate with the vendor on new business opportunities that will bring rewards over the long term. They jointly experiment with high-risk process innovations that can deliver value across the end-to-end supply chain—i.e., from lower-tier suppliers

to customers. For example, a leading apparel manufacturer collaborated with its major supply chain vendor on experimental processes aimed at improving distribution to major markets by resequencing the steps and locations to finish products (e.g., color). This innovation enabled the manufacturer to be much more responsive to demand uncertainty by postponing key decisions. Only a small number (7%) of the relationships we studied used the Exploration Mode of collaboration.

Dual Mode

Customers engaging in Dual Mode collaboration work with the supply chain services vendor both to improve their supply chains and innovate them. These customers share knowledge on existing and new opportunities to create both short-term and long-term value. Their collaboration with the vendor encompasses both local, narrow improvements to selected subprocesses in the supply chain and global, broader changes. For example, a leading manufacturer of notebook computers collaborated with its logistics partner to streamline its existing distribution to retail outlets as well as to develop an innovative, responsive network to process returns and repairs. About one-fifth (19%) of the relationships we studied used the Dual Mode of collaboration.

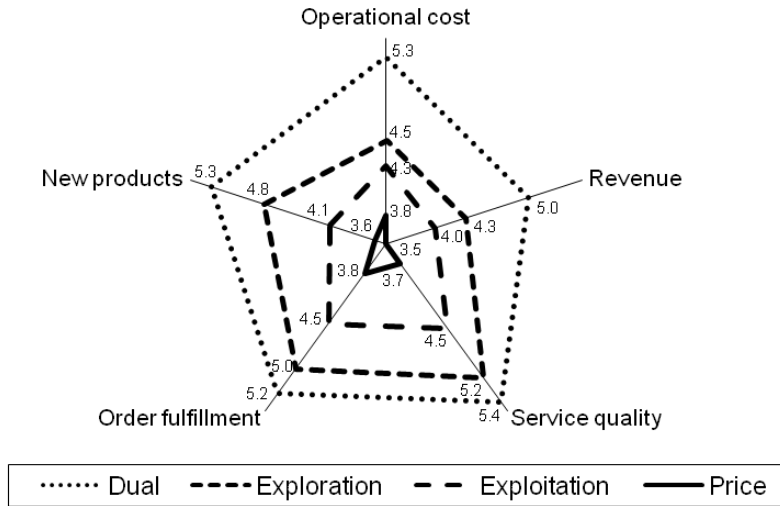
BUSINESS VALUE ACROSS COLLABORATION MODES

Our study found that supply chain relationships have an impact on five major key performance indicators (KPIs) of business performance: (1) operational cost, (2) revenue growth, (3) service quality, (4) order fulfillment time, and (5) launch of new products. However, as Figure 2 shows, each collaboration mode is pursued to improve a different set of KPIs. The Price-only Mode is pursued to impact operational cost and service quality; the Exploitation Mode is pursued to improve operational cost, service quality, and order fulfillment; the Exploration Mode is pursued to

Figure 2: Key Performance Indicators Vary by Collaboration Mode

Collaboration Mode	Operational Cost	Service Quality	Order Fulfillment	Revenue Growth	New Product Introduction
Price-only	●	●			
Exploitation	●	●	●		
Exploration			●	●	●
Dual	●	●	●	●	●

Figure 3: Each Collaboration Mode Has a Different Impact on KPIs



Survey respondents rated the impact on each KPI on a 7-point scale (1 = Strongly Disagree; 7 = Strongly Agree). Average values for all relationships in a collaboration mode are shown.

improve order fulfillment, revenue growth, and new product introduction; and the Dual Mode is pursued to improve all five KPIs.

Our customer survey data also revealed that perceptions of performance differ by collaboration mode (see Figure 3). Customers with Dual Mode relationships rated the impact on all five KPIs the highest, suggesting that the synergies from sharing both exploitative and exploratory knowledge impact all KPIs. Interestingly, those with Exploration Mode relationships rated the impact on each of the five KPIs higher than those with Exploitation Mode relationships. The Exploitation Mode, with its focus on a narrower aspect of the supply chain and short-term improvements, appears to generate lesser benefits in operational cost, service quality, and order fulfillment than the Exploration Mode. However, the Exploration Mode, with its focus on the end-to-end supply chain process and long-term innovation, generates greater benefits on all five KPIs relative to the Exploitation Mode. As expected, customers with Price-only relationships rated the impact on all five KPIs the lowest, confirming that the least joint value is created through relationships based purely on market interactions.

IT CAPABILITIES FOR SUPPLY CHAIN COLLABORATION

To identify the IT capabilities that play a role in co-creating value in supply chain relationships, we synthesized our findings from in-depth discussions and interviews conducted over a five year period with account managers and IT personnel responsible for over 100 customer relationships. We discovered three IT capabilities that are associated with effective collaboration in supply chain relationships.⁷

1. A *Synchronized Operations* capability is used to coordinate events, activities, and decisions, and to manage resource flows within and between partner organizations. This capability establishes global visibility into processes and embeds real-time business intelligence into workflows for exception handling, error discovery, and automatic adjustment.
2. A *Reflective Business Intelligence* capability is used to exploit IT to discover opportunities for improvement and innovation of supply chains. Data warehouses and business intelligence tools enable not just data mining but also process mining, where detailed process traces are evaluated from the perspective of multiple

⁷ For a related discussion on IT requirements to enable different modes of governance of value nets, see Rai, A., Sambamurthy, V., and Agarwal, A., op. cit., 2008.

Figure 4: IT Capabilities for Supply Chain Collaboration

IT Capability	Examples
Synchronized Operations	<ul style="list-style-type: none"> • Integrated multi-channel supply chains for moving finished goods to customers (e.g. direct and via a distribution center, online and offline retail stores). • Integrated “womb to tomb” process with rigorous real-time coordination (e.g., integrate the flow of orders, shipment, and finances). • Detailed visibility into resource flows (e.g., provide location and status of goods and activities on a dashboard). • Intelligent operations that exploit business rules and visibility for automatic correction (e.g., reroute shipments because of a bottleneck in a trade lane). • Dynamic adjustment of operations based on changes in customer requirements (e.g., automobile dealer revises interior specifications for a Mercedes-Benz shipment that is en-route. The changes are cascaded to update the delivery plans of the logistics vendor and the assembly plans of the final-stage vehicle processing center).
Reflective Business Intelligence	<ul style="list-style-type: none"> • Analysis of the allocation and trend of historic costs across activities to detect inefficiencies (e.g., how freight costs should be coordinated across road, rail, sea, and air). • Mining of data to discover pattern of errors, source of problems, and implications for deviations from negotiated service level agreements. • Mining of process traces to discover how activities and events are being executed, and when and why they deviate from standards.
Digital Boundary Spanning	<ul style="list-style-type: none"> • Standardized data transfer (e.g., EDI-based standards). • Standardized interfaces to efficiently share information between processes of the customer and vendor (e.g., RosettaNet Partner Interface Process [PIP] to notify shipping order or to query shipment status). • Document management to represent and exchange semi-structured information (e.g., XML-based documents, operational and business plans). • Modeling and visualization to establish shared understanding of processes and outcomes (e.g., supply chain operations reference model, process models, and business models).

roles to diagnose problems and to surface opportunities and solutions.

3. A *Digital Boundary Spanning* capability is used to establish data standards to facilitate transfer and consistency of structured data, to document management capabilities that represent and exchange unstructured information, and to enable visualization capabilities that promote shared understanding and negotiation about the collaboration.

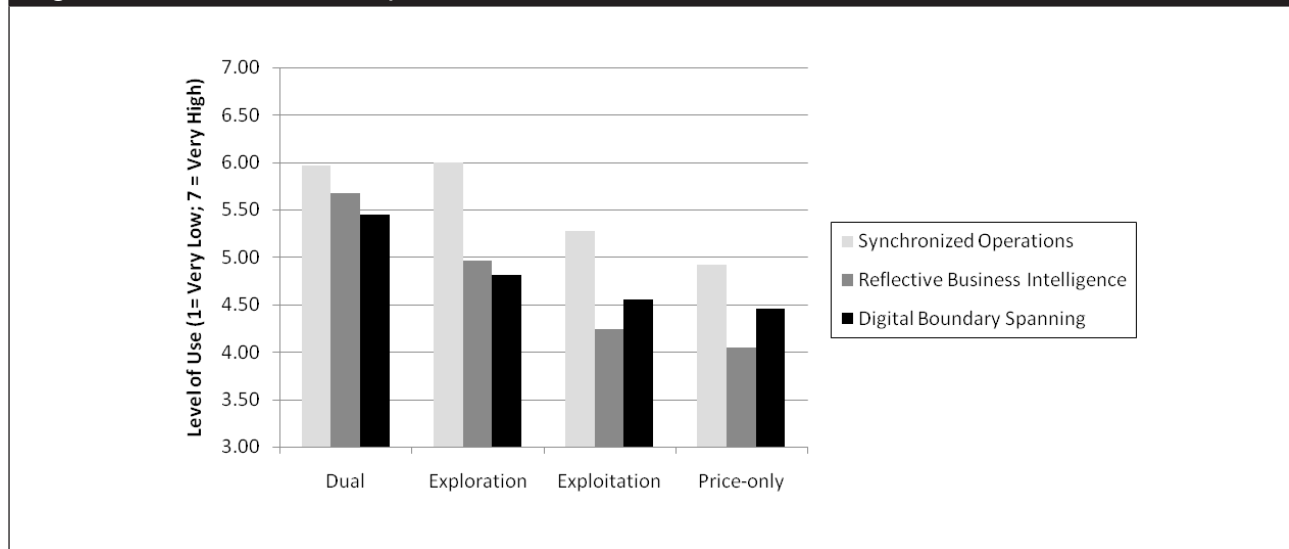
Figure 4 lists some examples of each of these IT capabilities.

ALIGNING IT CAPABILITIES WITH COLLABORATION MODE

Our survey data enabled us to profile the IT capabilities that are used by “high performance companies”⁸ for each collaboration mode, allowing us to determine whether different collaboration modes require different IT capabilities. Figure 5 summarizes the use these high-performance firms made of the three IT capabilities for each collaboration mode, and our findings are described below.

⁸ High-performance companies in a collaboration mode were those that rated the impact on the KPIs for that mode as 5 or higher on a 7-point scale (1 = Strongly Disagree; 7 = Strongly Agree).

Figure 5: Profiles of IT Capabilities for Collaboration Modes



IT Capabilities for the Price-only Mode

The Price-only Mode requires only a moderate level of Synchronized Operations and Digital Boundary Spanning and a low level of Reflective Business Intelligence. Relationships operating in this mode establish IT capabilities to coordinate operations that are distributed across the vendor and customer firms, with their IT infrastructures automating real-time data transfer, supporting multiple standards, and embedding business rules in workflows. As expected, IT for the joint discovery of business intelligence is used only minimally, as the focus is not on value co-creation either through improvement or innovation.

IT Capabilities for the Exploration and Exploitation Modes

Compared with the Price-only Mode, both the Exploration and Exploitation Modes make more use of all three IT capabilities. Relationships in these modes exploit IT to synchronize commerce to a much greater degree than the Price-only Mode, with a particular focus on using IT to collect granular data related to events, activities, exceptions, and outcomes. They also make greater use of Reflective Business Intelligence. For Exploitation relationships, Reflective Business Intelligence is directed at discovering how to fine-tune processes for short-term operational gains. For Exploration relationships, Reflective Business Intelligence is directed at discovering how to innovate processes for gains in the long term. Finally, relationships in these two modes establish IT capabilities not only to share data and information but also to represent and negotiate complex processes, a variety of roles, and an array of outcomes. These

capabilities enable the parties in a relationship to develop a shared understanding about how value can be created, how roles and responsibilities can be restructured, how activities can be executed and how outcomes can be measured.

IT Capabilities for the Dual Mode

High-performance relationships in the Dual Mode make high use of all three IT capabilities. They make the greatest use of Reflective Business Intelligence and Digital Boundary Spanning. They also make about the same level of use of Synchronized Commerce (5.97 on a scale of 7.0) as the high-performance relationships in the Exploration Mode (6.0 on a scale of 7.0). They aggressively exploit IT for synchronized operations by embedding real-time business intelligence into workflows and by tracking events, activities, outcomes, and exceptions in detail. They mine the process traces to generate reflective business intelligence on the redesign of processes and on the revision of business rules. They span the knowledge boundaries between vendor and customer by using standards for real-time data transfer, XML-based systems for the translation of documents, and process models and simulations for the negotiation of processes, roles, and outcomes.

ALIGNMENT GUIDELINES

We set out below our guidelines for the actions CIOs and business executives can take to best align their objectives for their supply chain vendor relationships, their collaboration modes for these relationships, and their firms' IT capabilities to support them.

Guideline 1: Establish a Performance Scorecard

The performance scorecard should be based on the value co-creation objectives for a given supply chain relationship by selecting from the five KPIs: operational cost, revenue growth, service quality, order fulfillment time, and launch of new products.

Guideline 2: Choose the Appropriate Collaboration Mode

Adopt the Price-only Mode for market interactions, the Exploitation Mode for low-risk improvement and short-term value co-creation, the Exploration Mode for innovation and long-term value co-creation, and the Dual Mode for both short-term improvement and long-run innovation.

Guideline 3: Match IT Capabilities to the Collaboration Mode

Ensure that IT capabilities align with the chosen collaboration mode by assessing the three complementary IT capabilities described above: Synchronized Operations, Reflective Business Intelligence, and Digital Boundary Spanning. While a moderate level of Synchronized Operations suffices for the Price-only Mode, its importance increases for the other three value co-creation modes, especially because of the increased importance of real-time business intelligence in workflows. The Exploitation, Exploration, and Dual Modes require significantly greater Reflective Business Intelligence and Digital

Boundary Spanning capabilities than the Price-only Mode.

Guideline 4: Evaluate the Net Benefits of Migrating From One Collaboration Mode to Another

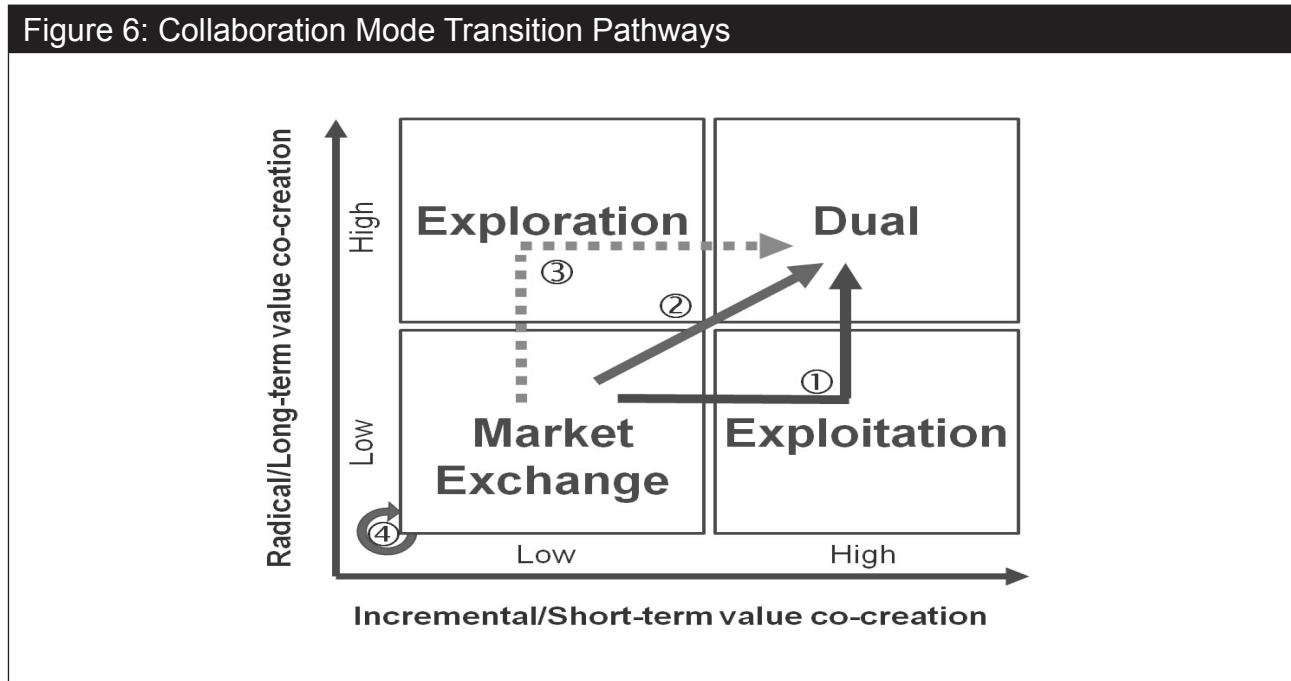
Our study provides strong evidence that greater value can be co-created by transitioning supply chain relationships from the Price-only Mode to one of the other three collaboration modes. To improve the KPIs, however, all three of the other collaboration modes require investments in capabilities for joint learning and knowledge exchange between the customer and the vendor.

Guideline 5: Select a Transition Pathway

The choice of path for transitioning from one collaboration mode to another should be selected to take account of:

- The objectives of both the client and vendor.
- Their propensity to share knowledge and pool the risks of innovation.
- The costs that would be incurred to establish the IT capabilities needed to support the new collaboration mode.

Figure 6 shows three alternative pathways to transition from the Price-only Mode to the Dual Mode. Pathways 1 and 3 represent a staged approach to Dual Mode collaboration. Pathway 2 represents a



much more complex shift, as it requires simultaneous adjustments in IT capabilities to accommodate both joint exploitation and joint exploration.

can facilitate the vitality of long-term supply chain relationships by enabling ongoing value co-creation. The answers to the key questions that CIOs need to address when aligning IT capabilities with supply chain relationships are set out in Figure 7.

CONCLUSION

Supply chain relationships differ in value co-creation objectives and the different objectives require different collaboration modes, each of which requires different IT capabilities to achieve the objectives. A change in objectives for a given relationship requires an effective migration from one collaboration mode to another, as well as the IT capabilities needed to support it. By understanding the correspondences among relationship objectives (measured by KPIs) and the modes of collaboration, CIOs and IT managers can align IT capabilities with the business objectives for the relationship. Through this alignment, they

Figure 7: Answers to Key Questions About Supply Chain Relationships	
Question	Key Insights
What collaboration modes are used for supply chain relationships?	<ul style="list-style-type: none"> • Four modes exist: Price-only, Exploitation, Exploration and Dual.
What key performance objectives are associated with the different collaboration modes?	<ul style="list-style-type: none"> • Objectives for the five KPIs—operational cost, service quality, order fulfillment, revenue growth, and launch of new products—vary by collaboration mode: <ul style="list-style-type: none"> ○ Price-only Mode: operational cost and service quality. ○ Exploitation Mode: operational cost, service quality, and order fulfillment. ○ Exploration Mode: order fulfillment, revenue growth and new product introduction. ○ Dual Mode: all five KPIs. • As relationships transition from Price-only to the value co-creation modes, higher performance is realized across all KPIs.
What IT capabilities play a role in creating value in supply chain relationships?	<ul style="list-style-type: none"> • The three IT capabilities that enable the collaboration modes are Synchronized Operations, Reflective Business Intelligence, and Digital Boundary Spanning.
What IT capabilities are associated with the different collaboration modes?	<ul style="list-style-type: none"> • Price-only Mode: moderate levels of Synchronized Operations and high use of IT standards. • Exploitation Mode: embedded real-time intelligence for Synchronized Operations, refinement of real-time intelligence and of automated synchronization of processes. • Exploration Mode: Synchronized Operations complemented by rich Digital Boundary Spanning and Reflective Business Intelligence. • Dual Mode: Synchronized Operations complemented by real-time intelligence, Reflective Business Intelligence, and rich Digital Boundary Spanning.

APPENDIX 1: ABOUT THE FIELD STUDY

Over a period of five years, we conducted interviews with account managers and IT executives responsible for over 100 long-term relationships at the supply chain services vendor and at its customers to understand the nature of collaboration and the IT capabilities that are deployed in these relationships. Based on these interviews and after consulting the literature, we developed a survey questionnaire designed to measure the types of knowledge sharing, IT capabilities, and relationship performance. The survey was sent to the account managers at customer firms who were responsible for managing their firms' relationships with the vendor and were the most informed about the issues being studied. Of the 238 responses received, 81% were from mid-level managers and analysts, and 19% were from senior managers. The supply chain relationships had been in place for an average of 7.3 years. Customers sourced an average of 37.8% of their total contract dollar volume for supply chain services from the vendor. Four industries accounted for the majority of the responses—manufacturing (67%), wholesale trade (12%), professional, scientific, and technical services (5%), and retail trade (4%).

APPENDIX 2: WHAT WE ASKED THE CUSTOMER ACCOUNT MANAGERS

Customer account managers rated items on a seven-point scale ranging from 1= Strongly Disagree to 7= Strongly Agree.

Relationship Performance

By working with this partner, our company (or business unit) has received the following benefits over the past two years:

- Reduced operating cost.
- Increased revenue.
- Improved service quality.
- Faster order fulfillment.
- Improvement in the launch of new products.

Exploratory Knowledge Sharing

Our companies exchange:

- Knowledge related to experimentation (e.g., pilot tests) for new business opportunities.

- Knowledge related to strategies for long-term success.
- Novel ideas for the long-term success of the relationship.
- Knowledge related to new approaches for end-to-end supply chain service process integration.

Exploitative Knowledge Sharing

Our companies exchange:

- Knowledge related to improving compliance with short-term goals.
- Knowledge to refine existing measures for assessing short-term performance goals.
- Knowledge for low-risk, short-term improvements.
- Knowledge related to refining a few selected parts of the supply chain service process.

Note: The responses to the questions on knowledge sharing were used to determine the collaboration mode. The relationship was classified as *Exploration [Exploitation]* Mode if exploratory knowledge sharing was high [low] (i.e., greater than [lesser than or equal to] 5 on the 7-point scale) and exploitative knowledge sharing was low [high] (i.e., less than or equal to [greater than] 5 on the 7-point scale). It was classified as *Dual* Mode if both types of knowledge sharing were high and as *Price-only* Mode if both were low.

IT Capabilities for Synchronized Operations

For this relationship, our company relied on information systems support to:

- Conduct operational routines.
- Execute a sequence of activities.
- Comply with standardized procedures.

IT Capabilities for Reflective Business Intelligence

For this relationship, our company relied on IT support to:

- Generate inferences from past events (e.g., exceptions about supply chain services, and what worked and what did not).
- Create new interpretations by combining information (e.g., uncovering trends and patterns about supply chain services).
- Construct multiple interpretations (e.g., electronic dialogue to exchange different perspectives).

- Represent information in multiple ways (e.g., slicing and dicing of information based on the requirements of different roles).

IT Capabilities for Boundary Spanning

For this relationship, our company relied on the following:

- Databases and repositories with consistent data (e.g., databases for consistent tracking of shipment and inventory data).
- Standards for data representation (e.g., common formats for file layout, record, and field lengths).
- Structured and semi-structured documents with shared meaning across the relationship (e.g., EDI and XML documents with agreed definitions for shipment and inventory).
- Unstructured documents with shared meaning across the relationship (e.g., PDF and multimedia documents with agreed definitions for activities and performance).
- Process models (e.g., specification of roles, activities, measures, and process interfaces).
- Business models (e.g., computational models about risk and return).

Information Systems Journal, and *The DATA BASE for Advances in Information Systems*, among others.

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