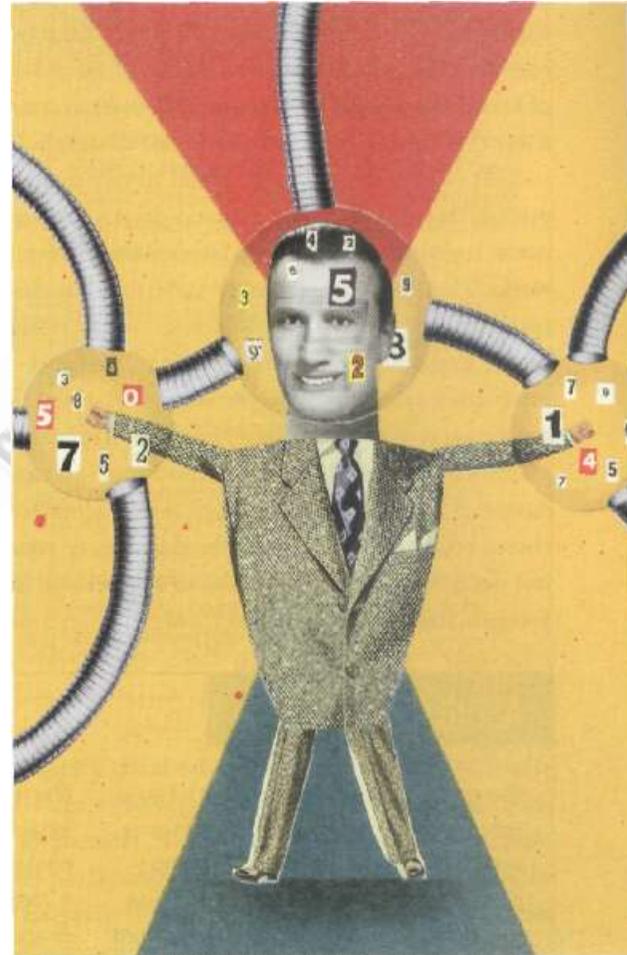


Sharing Global Supply Chain Knowledge

There are two categories of supply chain partners: those that buy and those that sell. Depending on which group they identify with, managers have different perspectives on the value of sharing critical knowledge resources with their supply chain partners. Both groups agree that sharing knowledge makes for more efficient supply chains (with lower costs and quicker speeds) and more effective organizations (with higher quality outputs and enhanced customer service). But the benefits of knowledge sharing don't always accrue equally or simultaneously to all participants.

In addition, some managers think that knowledge sharing between buyers and suppliers has an underappreciated "dark side" that can outweigh the benefits.¹ A common worry is that divulged information regarding technologies, pricing schedules, client bases and processes can be copied or shared with competitors. Another worry is that relying on knowledge flows from other organizations can undermine a company's flexibility and leave it vulnerable to changes in its partners' priorities. Despite these concerns, knowledge sharing between supply chain partners offers more positives than negatives, provided that the right kind of knowledge goes back and forth.

What type of information or knowledge should suppliers and buyers share with each other? How does knowledge sharing provide value to buyers and suppliers, and under what circumstances can it help both? How do cross-cultural differences between global buyers and suppliers influence the value of sharing information? To answer these questions, we studied more than 100 cross-national supply chain partnerships in the industrial chemicals, consumer durables, industrial packaging, toy and apparel industries in 19 country locations. (See "About the Research," p. 68.) We examined how different types of knowledge sharing can benefit buyers or sellers individually. But more importantly, we studied how knowledge sharing can enhance the performance of partnerships and build stronger supply chains in the global marketplace. We sought to understand not only which companies benefit from cross-border knowledge sharing but also the conditions that lead to knowledge sharing in global supply chains. Many people see knowledge sharing as the result of customer or supplier needs when in fact it is more likely to be influenced by market structures or organizational similarities and dissimilarities between buyers and suppliers. (See "What Makes Knowledge Sharing Possible?"⁷¹ p. 69.)



Knowledge sharing between partners has more upsides than downsides, provided that the right kind of knowledge goes back and forth.

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The Value of Knowledge in Global Supply Chains

In a 2004 study, Hau Lee, a professor of operations, information and technology at Stanford University, found that top-performing supply chains had three distinct qualities.² First, they are *agile* enough to react readily to sudden changes in demand or supply. Second, they *adapt* over time as market structures and environmental conditions change. And third, they *align* the interests of all members of the supply chain network in order to optimize performance. These characteristics — agility, adaptability and alignment — are possible only when partners promote knowledge flow between supply chain nodes. In other words, the flow of knowledge is what enables a supply chain to come together in a way that creates a true value chain for all stakeholders.

This is a critical point. As global supply chains become less push-oriented and more demand-driven, organizations can come together more closely in demand-driven supply networks. These networks focus on understanding customer needs (present and future) and building supply chains based on actual demand levels as opposed to demand forecasts or production schedules. This permits a higher level of service to customers — more on-time deliveries and more accurate order placement — which, in turn, leads to increased levels of customer loyalty. Higher service levels actually help supply chains become more efficient, thanks to fewer product returns, less need for overnight deliveries to compensate for slow turnarounds and fewer dissatisfied customers.

Knowledge flow creates value by making the supply chain more transparent and by giving everyone a better look at customer needs and value propositions. According to AMR Research Inc., a business research company located in Boston, increased demand visibility (that is, more knowledge about real-time customer needs and demands throughout the entire supply chain) increases perfect order rates dramatically.¹ What's more, broad knowledge about customers and the overall market, as opposed to just information from order points, can provide other benefits, including a better understanding of market trends, resulting in better planning and product development.

Toyota Motor Corp., for example, increasingly involves its Tier 1 suppliers in major market-oriented decisions. According to Vikram Kirloskar, vice-chairman of Toyota Kirloskar Motor, a joint venture between India's Kirloskar Group and Toyota, this input would not have much value if Toyota and its suppliers didn't also share knowledge about markets.⁴ In several industries, including chemicals and packaged goods, initiatives are underway to facilitate knowledge flows between partners and to enhance customer value. For example, the European chemical industry estimates that it can save up to 2% of total industry sales through increased collaboration, including more knowledge sharing, between its supply chain members.³ Moreover, research consistently shows that the most common contributors to supply chain failures — out-of-stocks, excess inventories, new product failure rates, increased product markdowns and wasted time in engineering and

About the Research

Our research was conducted over a two-year period at the University of Tennessee, in cooperation with five partner companies and more than 100 of their overseas suppliers. The five companies represented the industrial chemical, consumer durable, industrial packaging, toy and apparel industries. Both the buyer and seller participants are multinational corporations operating from multiple locations in 19 countries: Argentina, Australia, Brazil, Chile, China, Czech Republic, Germany, Holland, India, Italy, Japan, Korea, Malaysia, Mexico, Poland, Singapore, South Africa, Taiwan and the United States. We conducted extensive telephone interviews with informants from the companies to understand their exchange context, the nature of their tasks and the relevance of the measures to their industrial experience.

The measures were derived from the extant literature and adapted to suit the context of our study. We then launched a Web survey through a multiple-contact strategy and collected data from 264 respondents (132 purchasing executives from the buyer companies and 132 marketing/sales executives from their corresponding overseas suppliers). The respondents were prescreened to ensure that they had significant knowledge about the exchange relationship we were studying. The dyads had worked with each other an average of 12.2 years and purchased more than \$400 million annually in materials. Partial least squares analysis was then conducted to test the hypothesized relationships between our proposed antecedents and knowledge sharing and the effect of knowledge sharing on company

performance. The results were all significant at the 5% level. MANOVA estimates were then generated to test for significant differences between benefits of buyers and sellers relative to knowledge-sharing activities. Thus, findings presented in this article are supported with empirical evidence. Following our quantitative research, we presented an executive summary to all participants and sought their feedback for our post hoc analysis, which was conducted through subsequent interviews with leading toy manufacturers in Hong Kong and major players in the pharmaceutical industry in the United States. We gratefully acknowledge the research assistance of the University of Tennessee's Supply Chain Forum Partners and all participants in the surveys and interviews.

research and development — are all addressable by increasing knowledge flows between supply chain partners.⁶ Still, some supply chain members are reluctant to participate in knowledge-sharing activities.

Why Knowledge Sharing Is Controversial

There is a saying that, in the global marketplace, companies don't compete — supply chains do. This is particularly true for industries in which there is a high degree of vertical integration and for specific markets, such as Japan, where long-term relationships between buyers and suppliers can trump competitive offerings from new players. Strong, cross-national supply chain relationships can create innovative environments that provide competitive advantages for member companies. Interorganizational learning and adaptation to volatile environments can facilitate symbiotic relationships between partners. It

can help both suppliers and buyers adjust to diverse demand levels in multiple marketplaces (including new product launches with no historical demand levels), increasingly complex trade regulations, risk pooling and process developments. Recent research shows that best-in-class companies in supply chain management were three times more likely than laggard companies to apply "visible technologies" that offer real-time customer and demand data; these technologies allow buyers and sellers to share knowledge more easily across borders.⁷ These applications, which go beyond radio-frequency identification and early replenishment programs, enable supply chain partners to maximize operational efficiencies and enhance customer value creation.

But intercompany knowledge sharing can have harmful competitive consequences. Many supply chain members we interviewed had an aversion to participating in activities that could provide more benefit to partners than to their own company. Increasingly, supply chain partners see themselves as competing among themselves for revenue. The CEO of a major global freight carrier expressed this concern: "We hear a lot about cooperation in global supply chains. And while I'm sure we benefit from close relationships with our partners, we feel there are two reasons why knowledge

What Makes Knowledge Sharing Possible?	
A variety of conditions, both environmental and organizational, facilitate knowledge sharing in global supply chains.	
Conditions Affecting Knowledge Sharing	How They Influence Knowledge Sharing
Market structures (economic and regulatory) for both buyers and suppliers	The greater the disparities between the buyers' and suppliers' market environment, the greater the tendency toward sharing knowledge between partners.
Environmental uncertainty in both the buyers' and suppliers' home markets	The greater the difficulty in forecasting sales volume, the greater the difficulty in predicting competitor moves; the greater the volatility in sales and market share for supply chain members, the more prone members are to share knowledge across borders.
Idiosyncratic investments or "specialty investments" for a specific supply chain relationship	The more member companies make investments (in the form of material, machinery, human resources, etc.) specific to the partnership, the greater their propensity to share knowledge with buyers or suppliers.
Organizational fit between buyers and suppliers	When company resources are complementary (i.e., of value to the partner company) and/or when strategies are compatible (when companies share the same goals and values), companies are more prone to share knowledge.

sharing in the supply chain can work against us. First, whenever we share knowledge with partners, it seems to leak to competitors, or potential competitors. Second, as the markets become more intense, we feel profits are in turn limited, and we compete with our partners for profit shares. So we want to be careful what we share. We want our partners to win, but not at our expense."⁸

Managers want to know that they can build equity through collaborative activities. At a minimum, they want an equitable piece of the "margin pie" relative to the resources they commit.

Given increasing levels of competition and customer expectations, many companies believe there is a fundamental conflict of interest among supply chain members. Players located between raw materials suppliers and retailers or e-tailers, in particular, see themselves competing with one another for profits. As a result, they are less likely to view supply chain partners as allies in improving operational efficiency or market effectiveness than as competitors for margins. When margins are thin, knowledge sharing and true partnership can revert to a more traditional (and more adversarial) vendor-buyer relationship. As David Yeh, honorary president of the Toy Manufacturers' Association of Hong Kong, noted, "Many toy OEMs are now competing directly

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with toy marketing companies such as Mattel and Hasbro in the same market. The competition has become more intense. Everybody is fighting over the same piece of pie."

Although the concept of "pie sharing" is not new, it is important to clarify the different ways that knowledge sharing helps suppliers and buyers and how the supply chain as a whole benefits from these activities.

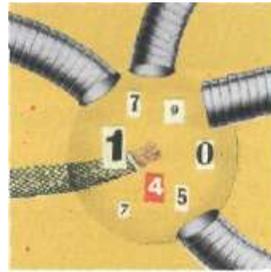
Different Types of Knowledge Knowledge sharing encompasses the sharing of information, but it doesn't stop there. Much of the information that companies share — data on inventory levels, sales, production schedules and prices — is easy to codify and transmit. But other types of knowledge are just as important to exchange and more difficult to codify: know-how, managerial and communication skills and organizational memory. Intercompany knowledge sharing is a joint activity between supply chain partners; the parties share knowledge and then jointly interpret and integrate it into a relationship-domain-specific memory that influences relationship-specific behavior.⁹ We found three types of knowledge sharing within the supply chain, each offering distinct benefits to buyers and suppliers: information sharing, joint sense making and knowledge integration (see "Types of Knowledge Sharing"):

- *Information sharing* takes place when companies exchange important data about sales, customer needs, market structures and demand levels.
- *Joint sense making* occurs when supply chain partners work together to solve operational problems, analyze and discuss strategic issues and facilitate communication about the relationship. Since individual partners often interpret the same information differently, intercompany teams can help create a common understanding.
- *Knowledge integration* occurs when supply chain partners develop relationship-specific memories, providing everyone with a common understanding of idiosyncratic routines and procedures governing the relationship. This often results in collective problem solving that benefits both the companies and the relationship as a whole.

These knowledge-sharing activities constitute mechanisms that can make or break supply chain partnerships.

Effective Knowledge Sharing in the Supply Chain

The greater the disparity between the market environments of buyers and suppliers, the greater the likelihood that partners will share knowledge. For example, in settings where customer preferences are changing or local regulations or supply sources are in a state of flux, cross-border partners rely on each other to serve as knowledge conduits. In general, market volatility makes companies more open to sharing knowledge; among other things, companies want to reduce bullwhip effects up the supply chain and the resulting stock-outs or overstocks. K.C. Lo, CEO of Smart Union (Hong Kong) Ltd., a toy manufacturer in Hong Kong with a global customer base, commented: "As manufactur-



The greater the disparity between the market environments of buyers and suppliers, the greater the likelihood that partners will share knowledge.

ers, we are also faced with the marketing challenge downstream. Our customers' sales and marketing problems directly affect our bottom line. Our interests are intertwined with everybody along the supply chain. If the products do not sell well and the buyers have to resort to markdowns, it is not uncommon in our industry to see buyers coming back to us and ask for a rebate. To overcome problems like this, we need inputs from the buyers along the value creation process to do a better job in meeting market demand. None of us can operate in isolation."

Companies with similar philosophies and goals have greater tendencies to share knowledge. Although this may seem intuitive, companies often partner with organizations that do not share the same business philosophies; subsequently, they are reluctant to share critical knowledge with each other. Again, while this may seem logical, it goes against the findings about

the importance of knowledge sharing in achieving competitive positions. A company's commitment to knowledge sharing is greatly influenced by whether it has made investments (for example, in special equipment, tools, machines or facilities) to support the buyer-seller relationship. Such investments tend to make a company more vested in the relationship and encourage knowledge sharing between partners.

The Role of Cultural Differences One of the more interesting findings is that cross-cultural differences between buyers and sellers rarely matter when it comes to sharing knowledge. We had assumed that culture and all of its nuances (such as differences in perceptions of trust, time and risk taking) would play a major role in whether cross-border partners shared knowledge and other valuable resources: A Japanese buyer of industrial chemicals, for example, would have perceptions radically different from his American supplier about how a partnership should work and what knowledge can be shared safely. However, cultural differences between buyer and supplier companies had no impact on their propensity to share knowledge. Interviews with managers revealed the reasons. First, cross-cultural differences have always mattered less in business-to-business relationships than they

have in business-to-consumer exchanges. Second, the nature of the businesses themselves is changing, becoming increasingly diverse both in terms of the employee base and in the number of markets businesses operate in. For example, one of the purchasing managers we interviewed was a Ukrainian working for a French company in Brazil. Identifying which cultural characteristics might influence his decision to share knowledge (Ukrainian, French or Brazilian?) would be impossible, and in reality this way of looking at culture proved irrelevant. Instead, there was an emergent global culture of business; decisions about whether to share knowledge — and how to do it — were driven less by cultural norms than by more objective decision making and market demands. As

Yeh of TMHK conceded, "Businesses are looking for best practice and best thinking. We have to put our cultural differences aside. I am seeing a converging trend in the last 30 years."

The Benefits of Knowledge Sharing

In measuring the performance of supply chain partners, it is important to recognize that businesses often have to make trade-offs between market share/sales and profits. Therefore, we combined four indicators to create an index to measure company performance: increases in market share, sales, return on sales and return on investment. Research on how much value buyers and sellers get from knowledge sharing has been confusing; some

studies show benefits, while others have shown dangerous repercussions.¹⁰ We found that, for both buyers and sellers, certain dimensions of knowledge sharing are critical for improved performance outcomes. Further, although all members of the supply chain need to participate in knowledge sharing, buyers and sellers do not always benefit equally. (See "Who Benefits From Sharing Knowledge?" p. 72.)

Both buyers and sellers indicated that information sharing and knowledge integration enhanced performance. They said that sharing information contributed to profitability and operating efficiency, benefiting both members in cross-national collaborations; they noted as well that frequent process adjustments and evaluations between partners also led to improved performance. In particular, knowledge sharing about market structures (for example, about mergers and acquisitions or regulatory changes), end-user preferences and profiles, technological innovations and financial resources helped everyone's bottom line. This was especially important for supply chain partners operating globally, due to the complexity of overseas markets and the difficulty of obtaining reliable information on their own. For example, the toy industry constantly faces regulatory changes and new safety requirements in overseas markets, as recent events involving Chinese imports in the United States illustrate." Without cooperation and knowledge sharing from their overseas customers, manufacturers would have difficulty responding to these kinds of challenges in a timely manner.

Knowledge sharing in global supply chains goes beyond information sharing. It is a joint activity in which supply chain partners strive to create more value together than they would be able to individually.

Conditions Affecting Knowledge Sharing

What Is It?

Information Sharing

Exchange of information on successful and unsuccessful experiences with products; exchange of information related to changes in end-user needs, preferences and behavior; exchange of information related to changes in market structure, such as mergers, acquisitions or partnering; exchange of information related to changes in the technology of the focal products; exchange of information as soon as any unexpected problems arise; exchange of information related to changes in the two organizations' strategies and policies; exchange of information that is sensitive for both parties, such as financial performance and company know-how.

Joint Sense Making

The establishment of joint teams to solve operational problems; joint teams to analyze and discuss strategic issues; development of a relationship philosophy that stimulates productive discussion using both buyer and supplier viewpoints; significant face-to-face communication in the relationship.

Knowledge Integration

Frequent adjustment of partners' common understanding of end-user needs, preferences and behavior; frequent adjustment of the common understanding of trends in technology related to the business; frequent evaluation and, if needed, adjustment of routines in order-delivery processes; frequent evaluation and, if needed, updating of the formal contracts in the relationship; frequent refreshment of the personal network in the relationship; frequent evaluation and, if needed, updating of information about the relationship stored in partners' electronic databases.

Who Benefits From Sharing Knowledge?		
WHEN BUYERS SHARE...	WHEN SUPPLIERS SHARE...	THE BOTTOM LINE
<p>...INFORMATION</p> <ul style="list-style-type: none"> Both buyers and suppliers benefit 	<ul style="list-style-type: none"> Both buyers and suppliers benefit 	<p>While both buyers and suppliers win, suppliers benefit more from basic exchanges of information between partners.</p>
<p>...IN JOINT SENSE MAKING</p> <ul style="list-style-type: none"> Buyers don't benefit, but suppliers do 	<ul style="list-style-type: none"> Both buyers and suppliers benefit 	<p>Knowledge-sharing teams and face-to-face communication are often time-consuming, but suppliers benefit from it. Buyers win when suppliers form teams, but not from their own efforts.</p>
<p>...IN KNOWLEDGE INTEGRATION</p> <ul style="list-style-type: none"> Both buyers and suppliers benefit 	<ul style="list-style-type: none"> Both buyers and suppliers benefit 	<p>When partners share databases and routines, both buyers and suppliers win, but suppliers win more.</p>

However, the advantages for buyers and sellers are not always equal: Suppliers receive significantly greater benefit than buyers from two types of knowledge sharing — information sharing and knowledge integration — no matter which partner actually shares the resources. Indeed, the outcomes are the same whether it is the buyers who do the information sharing or make the efforts to integrate knowledge bases into the operational protocols, or the suppliers. Both partners win — but suppliers win more.

In contrast to information sharing and knowledge integration, joint sense making appears to have different effects. When *suppliers* developed teams to work with partners, increase face-to-face communication and evaluate routines and processes, both buyers and sellers benefited. More than half of the 132 suppliers surveyed indicated high levels of joint sense-making activity; for their specific partnerships, both buyers and suppliers averaged significantly higher performance ratings than other partnerships. But when *buyers* promoted the same activities, suppliers were the ones that reaped most of the benefits. Half of the buyers indicated high levels of joint sense-making activity, yet in these partnerships suppliers enjoyed 6% higher performance ratings than their buyers. The disparity may be due to the significant time and other resources needed to build intercompany teams: Buyers tended to see this as an investment with few benefits for them; suppliers saw the potential benefits as well worth the expense. These findings reinforce the view that when suppliers are willing to dedicate time and resources to share their knowledge, the supply chain as a whole benefits.

Knowledge sharing between supply chain partners occurs with the expectation that both buyers and sellers will see benefits. And both parties do gain — just not equally. Not surprisingly, problems can emerge when one party feels it is not benefiting as much as its partners. Henry Liu, vice president of Starlight Industrial Ltd., a Hong Kong toy manufacturer, commented,

"Very often when we ask the customers [buyers] for information, we feel like we are talking to the wall. We have difficulties getting their commitment to do more knowledge sharing. The knowledge and information flow along our supply chain needs to be more effective." This imbalance - where managers see relative gains as more important than absolute gains — can undermine long-term cooperation within supply chains. In general, however, both buyers and suppliers felt that their collective knowledge-sharing efforts enhanced the value of their relationships with partner companies. They felt that knowledge-sharing activities helped reduce costs, increase product quality, enhance delivery performance and increase the overall quality of communication between companies. In short, whatever the disparities in

bottom-line benefits between buyers and suppliers, both groups felt that intercompany knowledge sharing was a valuable aspect of their global supply chain relationships. As Yeh of the TMHK noted, "Knowledge sharing between buyers and sellers is critical in a supply chain, even though it is often hard to quantify the actual size of the pie gained by each individual party. Both sides have to look at the ultimate picture and be more in sync."

One question that emerges from the research is: Why do suppliers generally benefit more than buyers? There are two factors: the predominance of demand-driven supply chains in today's global marketplace and the fact that suppliers have more room for improvement than buyers, who already tend to be quite lean. Increased competition has forced supply chain managers to become more agile and to tie their global models more closely to real-time consumption (as opposed to capacity or speculative sales forecasts). As a result, the knowledge that buyers share with suppliers is more valuable.

Demand-driven supply networks have been implemented by some of the best supply chains worldwide, including Toyota and Dell Inc.¹² Moreover, many successful suppliers, such as those supplying the automotive and aerospace industries, are becoming system integrators, producing components and whole systems for leading manufacturers.¹³ In the meantime, manufacturers (buyers) have had to simplify their approaches to lean manufacturing processes and become less rigid. A number of industries have already taken big steps in this direction, including U.S. aerospace and defense companies.¹⁴ Several major players, including Boeing, Lockheed Martin and United Technologies, recently formed the Supplier Excellence Alliance, comprising original equipment manufacturers and suppliers working together to accelerate supply chain performance. One of its primary initiatives is to help companies become effective participants in demand-driven supply networks.

Sharing Knowledge Across Borders

Several important lessons emerge from this. First, while suppliers may benefit the most from knowledge sharing, buyers also come out ahead. Frequently, supply chain partners focus too much on their own share of the benefits pie, forgetting that unless knowledge resources are shared, no one benefits. A company may not benefit as much from knowledge-sharing activities as its partners. But in absolute terms, its performance will be enhanced significantly. Without participation, knowledge sharing doesn't occur, and no one wins,

Second, dividing the benefits equally between suppliers and buyers may sound appealing, but in reality it may not be possible: One partner will always have more to learn than the other and thereby have a bigger upside. In most industries, suppliers have the advantage as global supply chains move toward more demand-driven models, giving buyers the upper hand. However, buyers have already seized many efficiencies. Suppliers, who are furthest removed from the point of final sale (and thus have the most room for improvement), have the next opportunity.

Suppliers need to realize that any real or perceived disproportional benefits on their part may cause tension in the relationship, and they need to be willing to address this problem. Among other things, they can show good will in the form of more generous division of profits, support for customers' R&D programs, discounts or preferred customer status. This would go a long way toward ensuring future knowledge-sharing benefits.

Third, in order to benefit from their partners' knowledge, companies need to participate in the sharing process. Even if a company feels that sharing certain information or knowledge resources is more of a potential liability than a benefit, it must recognize that there is a quid pro quo: A partner's participation in the sharing process will likely depend on the original company's willingness to do its part.

Finally, cross-cultural differences rarely matter, at least in the context of knowledge-sharing value. Managers repeatedly have heard that the greater the cultural distances between buyers and their suppliers, the less effective knowledge sharing can be. Our research found the opposite.

IN THE COMPETITIVE LANDSCAPE of global **supply** chains, knowledge sharing between buyers and suppliers has never been more critical. Although there is still a significant amount of hesitancy on the part of supply chain managers to share critical knowledge resources, experience shows that knowledge sharing can benefit both buyers and suppliers. If managers can come to terms with the often-disproportionate gains for suppliers and understand that some gain is better than no gain at all, both parties will benefit. Simultaneously, there may be room for suppliers to address the benefit disparities in order to reduce tensions among supply chain partners. If companies approach

global knowledge sharing constructively, supply chains will become more competitive — and everyone can win.

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