

Cover Story

Knowledge Management: The Supply Chain Nerve Center

By John Yuva

John Yuva is a writer for *Inside Supply Management*[™].

July 2002, *Inside Supply Management*[™], page 34.

Points of Interest

At a glance, here are the main points covered in this article. By reading it, you will learn:

- The enablers of knowledge management
- The difference between knowledge harvesting and knowledge creation
- How to implement knowledge management into the supply chain
- How to find and package knowledge

In supply management organizations, employees retire, business values change, and processes are redefined. Though this is a natural part of the business environment, how do these changes affect the informational supply chain? While information flow is an intangible part of the supply chain, its presence is a major factor in adding value to the supply management organization and its suppliers. Without an efficient knowledge management model in place, information that is critical to the current, ongoing, and future success of the supply chain may be jeopardized. In short, knowledge management is retrieving the right information, for the right people, at the right time.

While the previous two issues of *Inside Supply Management*[™] have covered aspects of the physical and financial supply chains, the informational supply chain focuses on the creation, capture, and comprehension of supply chain information. To grasp the complexity of this supply chain, the following areas will be discussed:

- Defining information and knowledge – how do supply managers differentiate between the two concepts?
- The role of information technology – how can supply management organizations use existing information technology systems for knowledge management?
- Moving forward into knowledge management – what supply management processes enable knowledge management to exist?
- Promoting knowledge management – how can supply managers promote knowledge sharing within the organization and externally with suppliers?
- Finding and packaging knowledge – where do supply managers find knowledge and how do they package it for the appropriate person or department?
- Factors for successful knowledge outcomes – what organizational and supply management behaviors affect knowledge management outcomes?
- Maintaining information integrity in the supply chain – how can supply managers ensure that the integrity of information is maintained throughout the informational supply

chain?

Defining Information and Knowledge

Without information, no supply chain would be able to function successfully or competitively. Supply management organizations would be operating independently and internal departments would be working in silos. There would be little feedback on whether the organization was meeting the needs of its customers. Thus, the informational supply chain is critical to the success of supply management organizations and their suppliers.

Within this supply chain, the type of information exchanged and its usage can be a deciding factor in how strategic an organization becomes in the marketplace. Unless information is accessed or shared and then used by supply managers, there is little chance that any competitive advantage will be realized. Consider the value potential between explicit information and tacit knowledge.

- Explicit supply management information – data, reports, and procedures retained within an information technology system. This information is readable and communicable. For example, a supply manager inputs the number of orders received each week into an information repository system. This data can be retrieved and explained explicitly to others in the supply management department or organization.
- Tacit supply management knowledge – deeper experience, expertise, and know-how of the organization. This knowledge is undocumented and exists in the minds of employees. For example, a retiring senior supply management executive demonstrates how to analyze various reports to forecast the next year's inventory. Without sharing this knowledge with the supply management staff, the department may be unprepared to effectively gauge the inventory needs of the organization after the executive retires.

Over the last few years, the focus of managing knowledge within organizations and between suppliers has come to the forefront. As supply management organizations have quickly realized, information technology can play a pivotal role in the knowledge management arena.

The Role of Information Technology

Many supply management organizations are just now exploring the bottomline potential of knowledge management. Because many firms are decentralized, providing critical information to the right people at the right time is often unsuccessful and rarely recognized. However, the role of information technology is enabling the criticality of knowledge management to appear at the forefront in supply management organizations. Without the strategic element of information technology, knowledge management would have little success on a large-scale basis because of the required tools to retain and retrieve information.

Often, information technology and knowledge management are thought to be one in the same. Rather, information technology acts as a vessel for retaining and retrieving information, while knowledge management requires a human element to compile, analyze, and forward the information. Even then, the source must receive the information in a timely fashion, be able to comprehend it, and utilize it for any value to occur in the organization.

Moving Forward into Knowledge Management Models

When supply management organizations first began implementing information technology systems, many believed that the systems would provide knowledge solutions with regard to

the supply chain. However, as many supply managers realized, a major factor associated with information technology failures was the inability of these systems to adapt and fluctuate with the changing business environment.

Structured knowledge management model. As noted previously, information technology is limited in its ability to manage information. Yogesh Malhotra, founding chairman and chief knowledge officer for the BRINT Institute in Syracuse, New York, believes that the fundamental distinction between data and knowledge plays a major role in whether a system is designed for adaptation and quick response to change. He says that for routine, structured information processing within predictable business environments, the distinction between data and knowledge has little relevance because pre-specified outcomes have already been determined (see Model 1 above). For example, a supply management organization that manufactures a houseware item or provides cleaning services operates in a structured manufacturing or non-manufacturing environment. Supply managers already know that the final product will be a mixer or a cleaning solution. The needs of the supply chain can be retrieved from the information repository.

Unstructured knowledge management model. This is in sharp contrast to a rapidly changing manufacturing or non-manufacturing supply chain. While information technology can retain and retrieve changing data, it's incapable of comprehending the data in order to add value to the supply chain. "Dynamically and radically changing environments overwhelm the deterministic logic of a structured model, resulting in a 70 percent failure rate that has characterized implementations of knowledge management models," explains Malhotra.

Recounting his visit to a Silicon Valley high-tech consulting firm, Malhotra attributes most failed corporate intranet initiatives to the above fallacy. Inert and static information lying in any kind of repositories including intranets and portals alone does not result in business performance. Even within stable business environments, users' commitment and motivation to effectively use that information is critical. The role of users' motivation, commitment, and sense making becomes all the more critical when information needs to be critiqued, renewed, reconsidered, and modified to account for changing contexts of business performance. In other words, supply management organizations relied too heavily on information technology to comprehend how the organization and its suppliers should adapt to the changing business landscape rather than analyzing the information themselves.

Comparing an informational supply chain based upon pre-programmed, pre-specified outcomes to a knowledge management model wherein meanings, actions, and outcomes are based on creativity, adaptability, and agility is like comparing night and day. In a nonroutine, nonstructured information supply chain, such supply manager traits as attention, motivation, commitment, creativity, and innovation are the essential enablers of performance outcomes. These very traits also define the cornerstone of a successful knowledge management model. To highlight the structured and unstructured information supply chain processes, consider the following two knowledge management models:

- Knowledge harvesting – routine, structured information flow. Supply chains operating in this environment are using data and benchmarking reports to maintain a consistent manufacturing or service operation. "The *knowledge harvesting* process (seen in Model 1) focuses on optimization and efficiencies to squeeze competitive advantage from existing business processes before they are marginalized by changing competitive pressures and customer trends," says Malhotra. For example, a supply management organization that manufactures glassware will meet with its suppliers to share information on the latest methods to ship its product. Sharing this knowledge is an integral part of improving a structured supply chain where the final product remains

constant.

- Knowledge creation – nonroutine, unstructured information flow. Supply chains operating in this environment are using data and benchmarking reports to gather information in preparation for adapting to changes occurring in their manufacturing or service industry. "The *knowledge creation* process (seen in Model 2) is rethinking and redefining existing business models, business value propositions, and customer value propositions for the next cycle of knowledge harvesting," says Malhotra. For example, an electronics manufacturer gathers knowledge on changes in customer demand for the purpose of shifting its product focus in the future. Knowledge creation is the equivalent of supply chain forecasting, where organizations are attempting to identify trends in order to provide products and services when they're needed.

Supply management organizations may operate in a structured informational supply chain, an unstructured informational supply chain, or a combination of both. For example, both knowledge harvesting (structured) and knowledge creation (unstructured) models are taking place in computer manufacturing organizations. At the peak of its success in the desktop computer sector, an organization's supply management function runs smoothly because existing knowledge processes have been fine-tuned for harvesting the knowledge created over the prior years. Factors such as weekly forecasting, build-to-order, and customer service are well managed.

However, the organization also realizes that it must adapt to changes in the desktop market. With products such as servers and hosting applications becoming an important element for businesses, the organization must shift its focus and values in that direction to remain competitive. Supply managers must now analyze and be prepared for its future business model focusing on servers and hosting applications. This process would be considered the knowledge creation phase where future business models, business value propositions, and customer value propositions are defined for the next knowledge harvesting stage.

For either model to operate efficiently, information technology acts as a facilitator in storing, retrieving, and distributing supply chain information with human creativity and innovation as an enabler, which ensures ongoing assessment of performance outcomes and corresponding adjustment in inputs.

Promoting Knowledge Management

The key question then becomes how is knowledge management promoted within the supply management organization and externally with supply chain members? Bob Newhouse, senior knowledge management advisor for the Houston-based American Productivity & Quality Center (APQC), explains that some supply management organizations continue to build information repositories, best-practice-gathering databases, and Web portals only to realize that supply managers and suppliers are not accessing these tools.

While it's critical to have an effective information technology system, organizations must also examine the cultural, behavioral, and procedural aspects of using such a system. "As knowledge managers or senior management, we must make employees more effective, more efficient, feel motivated about their jobs, and feel plugged into a community within the organization," says Newhouse. "There are many payoffs that can accrue through knowledge management, but we really have to do a good job of making those benefits visible so that employees understand and appreciate why they should change and do something differently."

Consider the role of intranets within supply management organizations. On paper, the idea of

an intranet is appealing because it creates that sense of community for supply managers. The supply management department can create its own Web pages to disseminate information about the happenings and accomplishments in its area. However, Newhouse points out that before too long, an intranet that was intended to be easily accessible and informative is now too large for the organization to manage.

Because intranets can quickly accumulate thousands of pages of Web content, it becomes difficult to ascertain what's current and accurate. Content management is a primary component of knowledge management and a major issue for organizations because it brings to light the need to retire content when it becomes outdated and to hold someone accountable for maintaining accurate and up-to-date information.

Finding and Packaging Knowledge

Promoting knowledge management is becoming an essential component within the information supply chain. However, a critical part of knowledge management is communication and collaboration with the experts in the supply chain. In the past, communication between the supply management department and other internal departments was either uncommon or so routine ("Where is my order?") that there was little room for knowledge-based improvements to transpire. However, as the supply management profession has evolved, collaborative relationships are more abundant because of internal and external strategic initiatives. That collaborative spirit is one reason that the two most common ways of sharing person-to-person knowledge are through e-mail and informal discussions (often around the water cooler).

E-mail. Even with sophisticated knowledge management models in place, knowledge sharing is done in a more simplistic, inexpensive format. However, the challenge is capturing this knowledge for use on a larger, more strategic scale. For example, an e-mail message provides a record of the information retrieved, but unless that information is read, interpreted, forwarded, or printed for circulation, it adds little value to the decisionmaking process throughout the supply chain.

Informal discussions. The inability to circulate the information on a large-scale basis is also a challenge for informal discussions. A supply manager says to another that a problem is occurring when using the organization's procurement system. One offers the other a solution to the problem. This is certainly knowledge sharing, but how is that knowledge captured for use beyond the two individuals involved in the discussion? Newhouse of APQC says that much of his organization's research and focus is centered on communities of practice to address such issues. "Within communities is where a lot of tacit knowledge exchange, informal mentoring and apprenticeship, and access to experts within the organization can happen," he says. "It's a community that usually owns a body of knowledge or a set of processes, so there's a sense of ownership and community around that."

Organization-to-organization knowledge sharing. Private exchanges are becoming the most effective way to share and use knowledge throughout the supply chain. Originally, online auctions were expected to accomplish this task. However, what occurred in the online auction environment was more "electronic transacting" than knowledge sharing. Eric Lesser, research manager for the IBM Institute for Knowledge-Based Organizations in Cambridge, Massachusetts, says that knowledge-sharing information such as delivery specifications, billing practices, and product handling was not addressed in these large public systems. This caused difficulty for supply managers and their organizations to actually make use of the products once they were purchased. "As organizations move toward more collaborative development of products, the need for more intensive knowledge transfer between supplier

and purchaser will continue to increase," he says. "This includes developing a sense of trust between the two parties, and willingness to exchange knowledge beyond one's organizational boundaries."

Packaging information. Once knowledge is retrieved, the packaging of the information can play a major role in overcoming information technology challenges in the supply chain. With specific packaging, the context of information could be better understood. Malhotra of the BRINT Institute says that once routinized for efficiency and optimization, knowledge-harvesting processes may be delegated to others. However, supply managers need to be more proactively involved in knowledge-creation and knowledge-renewal processes that will define the next iteration of supply management networks and related business processes. "Information could be packaged so that it not only provides a quantitative or qualitative snapshot of any given process and its parameters, but highlights how the data relates to specific choices that need to be made by decision makers and how those choices relate to business performance outcomes," he explains. "This would help in bridging the gap between data that requires synthesis and interpretation and working knowledge that could be used by decision makers for more directly influencing business performance." In other words, information can be packaged for a specific product or process. Also, including its potential usage and outcomes aids in determining a valuable decision about the information. Again, it's providing the right information to the right people at the right time.

Factors for Successful Knowledge Management Outcomes

To achieve the most desired outcome from knowledge sharing, it's important for supply management organizations and their suppliers to adapt to current conditions and prepare for inevitable changes in the near future. The knowledge-harvesting process promotes accurate, up-to-date information, which makes it possible for the organization to build a trusting, information-sharing culture with its suppliers.

Trust is a valuable component that is necessary for supply management organizations to proceed into the knowledge creation process. Without a trusting, collaborative supply manager/supplier relationship, it would be nearly impossible to succeed in the knowledge creation phase of the information supply chain. Lesser of the IBM Institute for Knowledge-Based Organizations identifies the following changes in the business environment that supply management organizations and their suppliers should adapt to and prepare for as the information supply chain becomes more knowledge management based:

- Globalization – The need for supply management organizations to tap into the wealth of expertise located around the world. One cannot simply send out instructions from headquarters anymore. Supply managers must be empowered to search globally for expert knowledge about their industry.
- Growth of strategic alliances and joint ventures – More and more, the knowledge that is needed to be successful is not located within one's organizational boundaries. Therefore, it requires that more attention be paid to how it's exchanged and leveraged.
- Migration from products to services – As firms are looking to differentiate their products in a competitive environment, they are leveraging knowledge to create value-added products and services on top of them. For example, General Electric makes more profit on servicing aircraft engines and assisting airlines with maintenance than it does on selling the actual engines.
- Product complexity – As firms try to differentiate their products by adding more features, there is more to know about selling, distributing, servicing, and repairing these items. This is why it's imperative that supply management organizations and their

suppliers build strategic alliances and joint ventures in order to share knowledge about the inner workings of products and services.

- Changing nature of the workforce – The demographics of the U.S. workforce point to a greater number of supply managers who will be retiring in the next five to 10 years. Therefore, much of the experiential knowledge these employees have accumulated will be disappearing. Further, supply managers entering the field are less likely to spend their careers in one place – pointing to a need to continually retrain employees and get them up to speed.

Maintaining Information Integrity in the Supply Chain

By recognizing and adapting to change, supply managers are setting themselves on the right path for implementing knowledge management into their organizations and supply chains. As supply managers would expect, there are constraints when suggesting further decisionmaking processes that stretch beyond an organization's information technology tools, systems, and networks. However, overcoming these constraints maintains the integrity of knowledge shared throughout the information supply chain. Malhotra of the BRINT Institute lists the following seven constraints and enablers of knowledge management models as they relate to the structured and unstructured models of knowledge management on pages 36 and 38.

1. Business and technology strategy
2. Organizational control
3. Information-sharing culture
4. Knowledge representation
5. Organization structure
6. Managerial command and control
7. Economic returns

Organization enablers. Whether each item above is viewed as a constraint or an enabler of knowledge management, supply management organizations must overcome limitations of existing information technology systems in effectively meeting the strategic needs of the organization. In many cases, it's bringing into the foray the expertise, knowledge, and relationships embedded in the supply chain network and combining them with the capabilities of information technology tools. Furthermore, Malhotra says that synergy of "smart minds" and "smart technologies" also provides a basis for defining agile and adaptable supply chain networks that can withstand the challenges of a radically changing business environment. "By explicitly focusing on the business performance outcomes (rather than only on the inputs to the performance equation), they can better meet the corporate executives' demands for justification of investments in knowledge management models and supply chain networks," he explains. In other words, by identifying the changes occurring in the business environment, the limitations of existing information technology systems, and the value-added potential of knowledge management outcomes, supply managers can adequately justify why their organization should incorporate knowledge management principles into the information supply chain.

Supply manager enablers. From a more individual perspective, supply managers themselves can lead their organization in the behaviors necessary to implement a successful knowledge management model. Lesser of the IBM Institute for Knowledge-Based Organizations provides the following characteristics inherent in supply management organizations with successful knowledge management models. These characteristics will also aid the supply management department in overcoming the constraints often experienced when implementing a knowledge management model into the information supply chain.

- Awareness of the knowledge and skills of others – Supply managers need to know who knows what within the supply management and supplier organizations. If supply managers don't know who is the expert, they will ask the person that is easiest to contact (i.e., they will settle for "an answer" rather than "the right answer").
- Time and space to create, share, and apply knowledge – Supply managers must be able to respond to other employees' and suppliers' questions, investigate new ideas, understand how one situation can be applied to another, and train and mentor junior employees. Time is the most constraining resource with regard to sharing knowledge. As supply managers encounter new solutions and techniques, those ideas must be shared with the organization and suppliers.
- Trust – This element must exist between the knowledge seeker and the knowledge source. Research has shown that without a level of trust between those searching for knowledge and those who have it, effective knowledge sharing does not occur. Supply managers have to feel comfortable that the knowledge they share will not be misrepresented or misunderstood, and that they will eventually be recognized for their contribution.
- Common language and understanding – Without common agreement on vocabulary and background context, it's difficult to apply knowledge from one part of the organization to another. This is why collaboration is so critical because without it, a common language will be difficult to develop. To reach a level of common understanding and context involves the supply management department routinely sitting down with key representatives from other departments as well as suppliers to agree on standards for knowledge sharing.
- Recognition mechanisms for those who actively contribute their knowledge – If supply managers are recognized through promotions, presentations, and other mechanisms, this sends a strong signal to others regarding the types of behaviors that management is looking to support. If employees who are knowledge hoarders or who spend little time enabling others are promoted, other employees will begin to emulate those behaviors.

Knowledge management should not be considered a new business process, but a necessary component in an organization's bottomline profit strategy. While only one of four primary supply chain facets, its presence is essential to the success of every member in the chain. Without an information supply chain, organizations will operate only as separate entities with little understanding of the needs of their customers. Implementing an efficient information technology system provides an organization with a firm foundation to begin a large-scale knowledge management initiative. To be successful at knowledge management, the cultural, behavioral, and procedural aspects of the organization must be understood to give employees and business partners the motivation to become active participants.

Eureka!

While knowledge management initiatives are in the early stages for many organizations, those that have a system in place are finding that the investment was well worth the effort. This is certainly the case with Stamford, Connecticut-based Xerox Corporation. Its Eureka system enables the organization's 23,000 service engineers from around the globe to input product solutions into a knowledge base. When a machine problem arises with a Xerox product, the service engineer can access the knowledge base to find a product solution. The knowledge base currently holds 55,000 problem/ solution entries. If it's a unique situation where a solution doesn't exist in the knowledge base, the service engineer will voluntarily input the solution into the system once the machine problem is solved. Xerox estimates savings

between \$12 million and \$15 million per year as a result of its Eureka system.

Capturing Solutions

The impetus for the Eureka system began in the mid-1990s when Xerox's service engineers were discovering new problems with product launches that were not previously documented or found in training manuals. The engineers would find creative solutions specific for the customer site and share that information with a working group of five to seven people in the local office. However, that information never traveled beyond the local site unless the engineer sent an e-mail back to the documentation group who could update the product documents. The organization needed a system that could capture these unique solutions so that they wouldn't have to be reinvented and retain them in a database to be shared across service organizations.

Xerox called upon a small group of scientists in its Palo Alto, California research center (PARC) to go into the field with the service engineers, document their work processes, and speak with them about solving machine problems. After several months, the scientists began to experiment with several different system approaches that would allow the capture of these unique solutions at the product site, and their placement into a sharing system that would be available to every Xerox service engineer. The end result is the Eureka system that takes into account the technical, cultural, and procedural processes of the organization's service engineers.

Designing a User-Friendly Interface

One of the first requirements for the Eureka system was to create an interface that was easily adapted and tailored to the work style of the service engineers. It was decided that the interface would be created around the Web metaphor because most of the service engineers were familiar with working online. The interface allows each service engineer to search the knowledge base by problem symptom, product type, customer environment, or customer application. Also, because it's a global system, Eureka supports seven languages globally.

Putting the System to Work

To make the interface accessible anywhere, all of the service engineers are provided with a laptop that is loaded with the Eureka interface, as well as electronic documentation, electronic training, and diagnostic tools required for the service engineers to do their jobs. When the service engineer returns to the office, he or she can download updates to the knowledge base onto the laptop. Because everything is loaded onto the laptop's hard drive from the service engineer's office, Internet access is not an issue in using the Eureka system at the customer site.

The Motivating Factor

While the design of the Eureka system plays a role in its success, the real success factor is the service engineers themselves. It is the heavy participation of the service engineers and their motivation to volunteer solutions for the knowledge base that makes the Eureka system a success. What is the motivation behind a service engineer taking time out of his or her schedule to input a new solution into the knowledge base? Much of the motivation lies behind having his or her name attached to the solution and becoming an author, and then having that solution tip validated by a senior manager. This has added a level of quality and trust to every solution in the knowledge base because it has been qualified and screened and every user can see who authored and validated each solution.

From a supply management perspective, the Eureka system provides feedback to the documentation and supply management departments as each problem and solution is entered. Because supplier contracts and part changes are occurring regularly among Xerox's global customers, unique problems could occur related to differences in parts. As the unique solutions to these problems are entered, it loops the information to product designers and supply managers in order to alert them to make the necessary changes in documentation or supplies. The Eureka system is proving to be a benefit throughout the Xerox Corporation.

*Information provided by **Dan Holtshouse**, a director of corporate strategy for Xerox Corporation, Stamford, Connecticut.*

Data vs. Knowledge

Unfortunately, there is often a failure to differentiate between information systems and knowledge management systems. While one complements the other, the outcome processes are inherently different. The following lists the primary differences between data, information, and knowledge. Supply management organizations can consider their level of outcome processes by examining the characteristics of these three elements.

Data is a record of a transaction. It is easily captured and able to be structured into some form of repository. For example, supply managers can record the amount of a particular item they bought, the price they paid for it, the date they purchased it, the firm that they purchased it from, the time they expect it to be delivered, and the location where the material will be sent. All of these are examples of data that can be derived from a particular transaction.

Information is data that has been put in context. It has a sender, a receiver, and an intent to influence some form of behavior or decision. For example, if a supply manager purchased 60 percent of an organization's parts from three suppliers, or he or she receives 90 percent of the organization's deliveries within a 24-hour window, this is information.

Knowledge is the personal insight to which one can interpret and apply data and information. It is the heuristics, rules of thumb, and experiences through which supply managers actually make decisions. For example, if supply managers know that a particular trucking firm is late every Friday due to excessive summer traffic on the highways, they know that they have to order slightly more stock to meet the organization's customer demands. Knowledge can sometimes be captured in memos, e-mails, and other documents, but oftentimes the higher-value knowledge is tacit, or not easy to capture in a repository.

*Information provided by **Eric Lesser**, research manager for the IBM Institute for Knowledge-Based Organizations in Cambridge, Massachusetts.*

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Check out the Web sites below. These URLs provide additional information related to topics covered in this article.

- The Knowledge Management Resource Center

www.kmresource.com

- WWW Virtual Library on Knowledge Management
www.brint.com/km
- Knowledge Management Research Center
www.cio.com/research/knowledge
- Knowledge Management Pages
www.pathcom.com/~kat/k-windows/knowledge
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