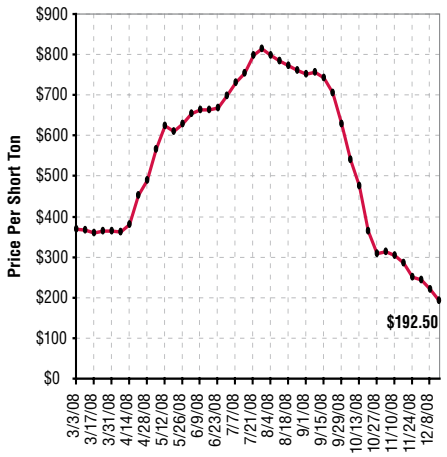
MIT-CTL
supply chain strategy
January 2009 // Volume 5 // Number 1
A newsletter from the MIT Center for Transportation & Logistics

INSIDE

Granular Urea: NOLA Barge March 2008 to December 2008 (Weekly Average)

.....see pages 6 and 12



NOLA = New Orleans, Louisiana Area
(Source: *Green Markets*)

Tetra Pak Takes Control of Global Transportation

GLOBAL VIEWS OF SUPPLY CHAINS ARE OFTEN IMPAIRED BY DIFFERENCES between national and regional transportation networks, making it difficult for companies to improve the management of freight flows across international markets. Swedish food processing and packaging enterprise Tetra Pak aims to remove these obstacles with the launch of a global transportation-management system in February 2009.

The system encompasses all modes and will give the company a single, real-time view of freight movements across the 165 countries in which it operates. Tetra Pak will analyze its shipments in new ways, enabling it to cut costs and raise the efficiency of its multinational transportation operations. And the company will control freight decisions for North America and Europe centrally, an uncommon approach to the management of goods movements across international time zones.

The new system will elevate transportation from its tactical base to a more strategic level, in line with other major components of global supply chains. This is particularly true for land modes, opening up new possibilities such as the sharing of best practices between countries.

Standard Procedures

Tetra Pak is one of three companies in the Tetra Laval group, a private company started in Sweden that is headquartered in Lausanne, Switzerland. With net sales of €8.6 billion ($12 billion), Tetra Pak supplies equipment and packaging products for food that cover every stage of the production process. For example, if the product is milk, the enterprise provides processing equipment and packaging that takes the product from the cow to the supermarket shelf.

The other two companies in the group are DeLaval, which provides complete systems for milk production and animal husbandry, and Sidel, a maker of filling and blowing equipment for plastic bottles. Tetra Pak is the largest company in the group.

Continued on page 2

Tetra Laval Group Transport & Travel department is based in Sweden and negotiates transportation contracts in collaboration with the company's plants across the globe. The contracts for some €300 million per annum ($384 million) represent about 80 percent of the organization's total transportation spend and include €102 million ($130 million) on road and rail modes, €52 million ($67 million) for sea and ocean freight, and €23 million ($30 million) for express services.

"Just like many companies in the world today, we are a process-oriented company," said Kristian Malm, Global Procurement Road Freight. The standard process for procuring freight in the company is supplier management. "Everyone in supplier management is working with the same process," he said.

Whether procuring transportation to meet the specific needs of a new factory or qualifying a possible carrier for an existing operation, Tetra Pak requires transportation providers to complete a request for information, a standardized questionnaire that rates the providers in five areas: health, safety, environmental performance, quality, and service. "This is managed by us in Sweden, not the local office," said Malm. For example, Tetra Pak's U.S. plant in Denton, Texas, might relay details of a possible new carrier to Malm's office, which takes care of the qualification phase. Once that is satisfactorily completed, the contracting phase begins.

"We review the business needs, and we challenge our factories to continuously improve our processes before we go out and request a rate for a service," said Malm. This is done via a request for quotation, which includes key parameters such as freight volumes, routes, and rates and is sent to qualified transportation companies. Negotiations with freight companies are carried out jointly between the office in Sweden and factory shipping departments. For instance, Malm recently spent some weeks in Denton in negotiations with prospective carriers. "We will establish what we call a target based on all the offers we received," he said, and communicate the feedback to the carriers. "They come in with a second offer and again in cooperation with the factories, we select and contract suppliers."

Ongoing relationships with carriers are shared between local offices and the central procurement office in Sweden. "We own the contract but the factory is utilizing the service," he said. A process within supplier management called Supplier Base Management involves regular review meetings with carriers during which metrics such as cost, claims levels, and on-time delivery are evaluated. The financial health of service providers is monitored continuously. Tetra Pak is currently updating the metrics it uses to assess transportation suppliers, said Malm.

Going Global

About a year ago, the company started a project to develop a global management system for freight transportation. It is based on a control tower concept, where a tailored package of information services is used to help manage logistics activities. The term has become highly fashionable in the field and is interpreted in a number of ways, pointed out Malm. "We call it the Tetra Pak Logistics Control Tower, and it's based on our needs and no one else's," he emphasized.

The service will be provided by Transportation Management Center (TMC), which is a division of the U.S. company C. H. Robinson Worldwide Inc., one of the largest non-asset-based third-party logistics companies in the world. C.H. Robinson is headquartered in Eden Prairie, Minn., and the TMC organization is based in Chicago.

Tetra Pak already contracts with C. H. Robinson for transportation, but, as Malm stressed, this freight business

MIT-CTL SUPPLY CHAIN STRATEGY (ISSN 1557-9522) is published monthly for $595 per year by the Institute of Management and Administration, Inc., 1 Washington Park, Suite 1300, Newark, NJ 07102-3130. Periodicals postage paid at Newark, NJ and additional mailing offices. POSTMASTER: Send address changes to *MIT-CTL SUPPLY CHAIN STRATEGY*, 1 Washington Park, Suite 1300, Newark, NJ 07102-3130; 973-718-4700; fax: 973-622-0595; e-mail: subserve@ioma.com. The MIT Center for Transportation & Logistics (CTL) is a world leader in supply chain management education and research, ranking consistently as number one. CTL contributes to the academic knowledge in the field and helps companies gain competitive advantage from its cutting edge research. The Center's graduates occupy senior supply chain management positions in almost every industry and continue to use the Center's resources to update their knowledge and skills. Web: http://ctl.mit.edu. Tel: 617-253-5320.

will remain separate and distinct from the contract with TMC. When Tetra Pak set out to look for a third-party provider of control tower services, it used the same contracting procedure it deploys to appoint carriers with one additional step: The company specified what it wanted to pay for such services.

Going forward, "we will keep the procurement activity within Tetra Pak because we know our customers and our business best," Malm said. Moreover, outsourcing the contracting process to a third- or fourth-party logistics services provider would deprive Tetra Pak of valuable market intelligence and expertise, he noted.

Single-Sourced Information

The new venture has two primary operational goals. First, to rationalize the way Tetra Pak's worldwide transportation network is managed. "Today all of our factories do it differently and manually; they call or e-mail carriers, and there is no systems integration with the carriers," Malm explained. Second, to improve visibility in the supply chain. The supply chain segment that runs from the time a customer places an order to its dispatch from the relevant factory is well-tracked, "but after that we are blind," he said. Important milestones such as when loads are delivered to customers are not sufficiently visible, and the causes of delays and other service disruptions are often difficult to discern.

Why did the company opt to appoint a single third-party provider to improve the management of worldwide transportation services? For starters, "there is no 3PL that can service the whole world," observed Malm. As part of the deal, TMC is expanding its global footprint in line with Tetra Pak's needs. A control tower currently being established in Amsterdam, Netherlands, will cover Europe, and TMC's facility in the United States will run the system's North American region. Control towers in other parts of the world will be opened as the system develops.

Another reason for going the third-party route is that Tetra Pak avoids having to make a huge investment in its own IT capabilities. Also, using a single provider and keeping its existing network of carriers "saves us money in the design and development of the technology; we will have one global Web site where we can track all of our shipments," Malm said.

The Web site he referenced will be Tetra Pak's window on global freight movements for all modes of transportation. TMC will function as a clearinghouse for information on the whereabouts and progress of every Tetra Pak shipment. Notifications of key events such as load arrivals will be delivered by the site. "The reporting is updated every day, but the Web portal is real-time," said Malm.

Initially, the flow of information will take place between TMC, Tetra Pak, and carriers, but there are plans to bring customers into the loop by integrating the site into Tetra Pak's e-business system. That will give customers a single information source on the status of their orders within the end-to-end supply chain.

New Horizons

The analytical potential of unifying the many different streams of information in this way is seemingly limitless. As Malm explained, Tetra Pak contracts with about 130 carriers in different modes, and each entity supplies statistical and operational data in different ways. That makes meaningful analysis very difficult at best and impossible at worst.

By replacing this with a single portal, Tetra Pak will be able to analyze its global transportation network in ways that were not possible previously. For example, "we will be able to analyze waiting times per factory, routes, loading accuracy, lots of things that add cost today," he said. The way freight services are delivered will go under the same microscope, revealing new efficiencies since "there is a lot of cost that is hidden as an added service," said Malm. Another possibility is the sharing of best practices between carriers, regions, and countries.

These improvements are expected to add up to sizeable cost reductions for Tetra Pak. Malm cited two specific examples: the consolidation of carrier invoices through TMC and the consolidation of freight. In terms of the latter, the global view of shipments should highlight opportunities for combining loads from plants that are in the same geographic area but historically have acted independently on the dispatching of freight services.

Risk management is another area of operations that should benefit from the control tower concept. Armed with

[Key Takeaways]

- Managing the transportation of your goods nationally is difficult enough; when your theater of operation straddles multiple countries, the task is so complex that the usual approach is to rely on a patchwork of local management centers.
- Swedish company Tetra Pak aims to change all that with a global transportation system that uses a single, outsourced Web portal to deliver vital information on international goods movements. The system promises to elevate transportation to strategic levels.

a much clearer, broader view of freight movements, Tetra Pak will be better able to evaluate the systematic risks posed by localized disruptions. "And the analyses will help different factories to allocate product," observed Malm.

In the context of a global supply chain, Tetra Pak's control tower will bring an international dimension to freight transportation that is generally lacking, particularly on land. "We have seen it in parcel shipments and ocean how these services have become more global, but road lags behind, especially when you are procuring freight in different parts of the world," he said. At a fundamental level, "what we are talking about is traveling from A to B on wheels; it should not be that different depending on where you are in the world."

The other dimension that the control tower adds is strategic. "At our factories, shipping departments will change from being operational-tactical to more strategic, and they will analyze what they are doing to continuously improve their processes," Malm explained.

The control tower system will be launched in the United Kingdom in February 2009. Coverage will expand in 2009 to encompass Europe and North America, and the rest of the world will follow later. ◆

Weighing Your Sourcing Options

Regional and global choices in the balance

Should you source regionally or globally? In some situations the answer is self-evident; in others, the choice is less clear, particularly at a time when the cost advantages of globalization are less transparent than they were a few years ago.

Caterpillar Inc. is the world's largest manufacturer of construction and mining equipment, diesel and natural gas engines, and industrial gas turbines. In addition to serving global markets, the $40 billion company has a corporate target of attaining market leadership for every major product group on every continent by 2010.

To help it make the right regional and global sourcing decisions, the manufacturer has developed a process for assessing the different options for specific products. The methodology is not a perfect fit for every organization, but it shows how a systematic approach to sourcing can help companies arrive at optimum choices.

Shifts in Emphasis

Prior to the 1990s, Caterpillar, headquartered in Peoria, Ill., had a centralized purchasing organization, explained Carlton Adams, director, service parts purchasing. "Everyone had to follow the rules of this central organization," he said. It was decided to give more autonomy to business unit vice presidents, a move that made global purchasing more sensitive to the needs of each market. But the business leaders "built end-to-end silos," said Adams, that made it more difficult to leverage the company's purchasing power.

"Fast-forward to the new millennium and we reeled all that back," he said, as the company set out to capture sourcing efficiencies around the world. As part of that effort, Caterpillar is refining its approach to sourcing "to differentiate between regional and global opportunities." It is driving ownership of supplier relationships back to the individual business units while the purchasing discipline "owns the center of excellence frameworks."

In practice, each business unit has full responsibility for its supply chain and associated supplier relationships. But developing the relationships in areas such as quality management is co-owned by global purchasing, which also provides sourcing data.

The six sigma system underpins the organization's strategic sourcing strategy. In fact, the methodology for raising efficiency levels permeates Caterpillar and drives the organization's global business improvement efforts. In a sourcing context, "a six sigma strategic sourcing project, if it's done very rigorously, can take up to a year," Adams said.

Another distinctive feature of the Caterpillar approach to global sourcing is an emphasis on delivering value to internal customers. "There is a value proposition you have to offer whether you are serving a customer internally or externally," said Adams. He lists the long-term advantages that global purchasing delivers to Caterpillar internally as:

- Global leverage, local service excellence;
- Process consistency and excellence;
- Improved price, quality, and availability;
- Regional sourcing diversity in areas such as currency, geopolitics, and emerging market response times;

- Reduced warranty costs due to improved quality; and
- Stronger supplier relationships.

Questions of Balance

The divide between regional and global sourcing is well-defined at Caterpillar. Products with complex supply chains and elevated total costs that must meet high quality standards are generally confined to limited geographic areas such as the North America and Asia-Pacific regions. Examples include large, fabricated parts, gearboxes and drive trains, wheels, and tires. Low- to medium-cost products that meet minimum quality standards and are delivered by less complex supply chains tend to be allocated to the worldwide sourcing bucket. Air filters, basic electronics, and small plastic components fall into this category.

But these definitions serve as guidelines only; in reality, the lines between regional and global can become blurred. For example, a global supplier that has a footprint similar to Caterpillar's might also qualify as a regional vendor for products sourced worldwide, said Adams.

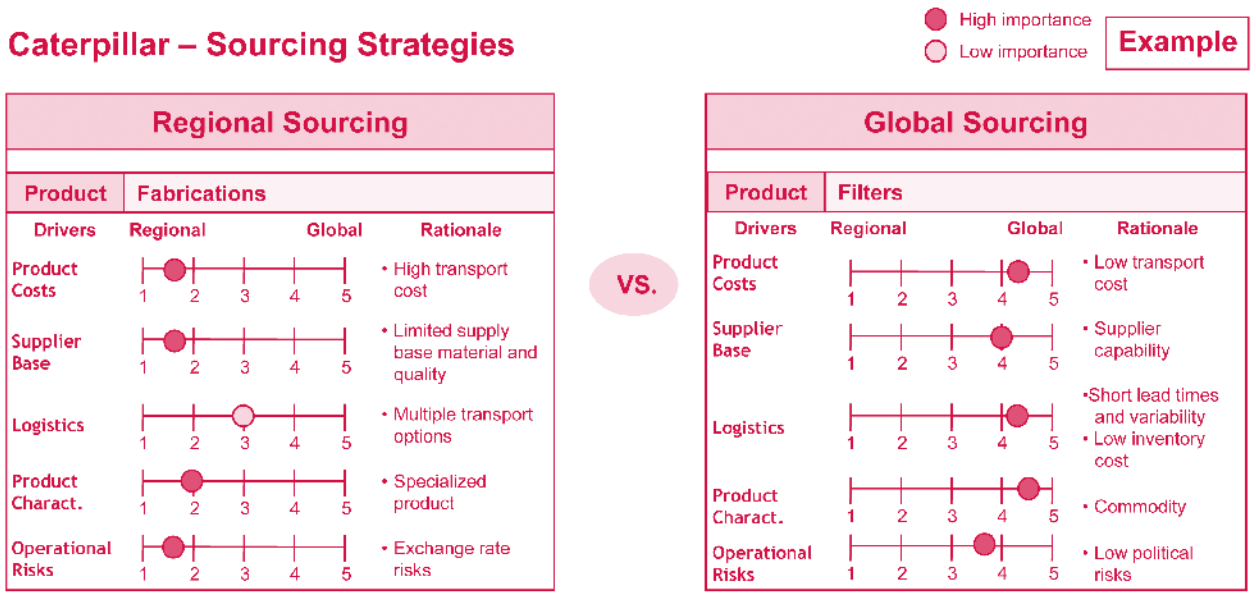
The aim is to strike a balance between regional and global sourcing programs that meets all of Caterpillar's criteria for cost-effective, high-quality products and delivers target benefits to internal customers. To achieve such a balance, the company makes trade-offs between total product cost, supply chain complexity, and product quality. The framework that Caterpillar uses to make these judgments has five components:

- Product cost, including the base and transportation costs, tariffs, and duties. This is the same as landed cost.
- The nature of the supply base; for example, is it mature and served by adequate infrastructure, and what is the availability of raw materials?
- Logistics and lead time factors, such as short- and long-lead-time variability and the adequacy of warehousing options.
- Product characteristics; how specialized is the product, can it be standardized, and is it high-tech or low-tech?
- The level of operational risk posed, including political, economic, and intellectual property risk.

In the current business environment, risk management has grown in importance, particularly when sourcing globally. Caterpillar maintains a supplier watch list that flags potential problems and generates risk profiles for each vendor as part of its performance management process for suppliers, Adams explained. "As purchasing directors we are spending a lot of time with our teams together with one another across the categories and regions we manage to try and understand what the supplier risk is and to make provision for anything we might need to shore up supply," he said.

Organizational preparedness—carrying out regular reviews with suppliers of their operational integrity—is another important element of this effort. "We have a supplier certification process and are trying to get a significant

Caterpillar's Main Sourcing Drivers Are Related to Transportation Costs and Supplier Base Availability



(Source: Caterpillar)

number of our core suppliers as certified Caterpillar suppliers," Adams said. "We have a lot of eyes looking at this."

Global Gauges

To help managers weigh global and regional options, Caterpillar uses a series of sliding scales to plot each of the five key components of a sourcing decision (see diagram). "The scales are something you will consider as you are flying into a decision," said Adams. "As you start to get down to the runway, then the decisions will come into a clearer view." There are scales for each product, and the drivers that are being measured are assigned a low- or high-importance weighting. Managers can compare the scores for regional and global sourcing options.

The scales are adjusted as conditions change, which can be often given the high level of market volatility that companies now have to contend with. For example, in collaboration with the Treasury Department, exchange rate allowances are altered to reflect changes in these parameters and in the company's hedging strategies. "We will get guidance from our economists and bake this into our forecasts," Adams said. The maturity level of a supply base can change quickly, as can cost elements, such as labor.

[Key Takeaways]

- In theory, your supply base should be an optimal blend of regional and global suppliers that balance your product needs; in practice, the demarcations between the two can be ambiguous.
- Global manufacturer Caterpillar brings clarity to these decisions with an emphasis on six sigma and sliding scales of attributes that help managers to identify the best mix of sourcing options.

Also, the scales are combined with sourcing managers' current knowledge of markets and a host of related factors to make decisions on whether a regional or global strategy is appropriate. For example, "How can I leverage a regional supplier into a global supplier based on my understanding of their vision for the business, and does it make sense to leverage the relationship as they continue to expand?" said Adams.

Caterpillar uses the same basic model to evaluate its sourcing strategies on an ongoing basis. The approach is also a useful tool for promulgating the importance of a sound sourcing strategy. "We are getting the organization to understand the value of sourcing in terms of bringing leverage to the enterprise and further refining that discipline to differentiate between regional and global opportunities," said Adams. ◆

Hedging Know-How That Pays Dividends

Supply chains that talk finance

THE USE OF HEDGING TO SHIELD ORGANIZATIONS against fluctuations in the cost of doing business has attracted much attention as markets have been thrown into disarray by the global financial crisis. The procurement and finance departments tend to drive hedging strategies, so is there a need for supply chain to get involved?

You may have no choice but to participate. An effective hedging program requires input from various disciplines including supply chain. And hedging programs should be part of demand-planning discussions, such as those that take place during sales- and operations-planning sessions.

Supply chain professionals do not need to become experts in the intricacies of hedging. However, a broad appreciation of how and why these programs work will help you make an informed contribution to these increasingly important programs.

Broader View

It helps to view hedging not as some exotic financial instrument but as part of a carefully planned and executed risk-management strategy. "Risk management is a way of life. It's a procedure that you implement and a process by which you always conduct business," said Keith Swanson, a fertilizer market risk management expert at St. Paul, Minn.-based energy, grains, and foods company CHS Inc. Swanson was speaking at the Managing Risk in a Volatile Fertilizer Market webinar, organized and hosted by the Pike & Fischer publication *Green Markets* on Oct. 29, 2008. Although the event was about risk management in fertilizer markets, much of the discussion on hedging applies to any business.

Swanson outlined an approach to managing risk in the crop nutrients industry that could form a backdrop to hedg-

[Key Takeaways]

- Hedging strategies come under the finance department's umbrella, but given the high level of market uncertainty that has become the norm, operations should at least have a passing knowledge of these instruments.
- Successful hedging requires input from supply chain, and you might even find that these programs can help you to perform.

ing strategies in many businesses. The approach also illustrates how supply chain plays a role in such programs.

First, "identify how much inventory you have to support," he said, by, for example, taking a percentage of annual inventory levels that is exposed to a high level of risk. Developing a daily position report that shows the company's net exposure to market risk is a useful exercise, he explained.

The next step is to establish an ongoing risk-assessment program that identifies the organization's risk profile. There are three components of such a profile: price risk, demand risk, and supply risk.

Having created the profile and pinpointed the primary risk, the organization can develop a strategy for dealing with it. For example, if the company is a fertilizer supplier that has sold more potash than it can source, then it is open to supply risk. If a supplier can't sell enough of its phosphate inventory, then demand risk is the main issue; this also leaves it open to price risk because there is an excess of phosphate on the market. Another example of a situation that exposes a company to price risk is when it has too much inventory stored in a warehouse during the buying off-season.

This is where hedging concepts can come into play. Swanson described these mechanisms as a way to transfer price risk in a procurement program (operated by the hedger) to another party (e.g., a speculator or another hedger) with the appropriate use of financial and cash instruments such as a swap (see sidebar). "The net effect is to separate the timing of the commitment to price from the timing of the delivery in the procurement process," he said.

The ultimate hedge is a back-to-back sale; you buy something and sell it simultaneously. In the absence of such convenient deals, the use of financial instruments such as derivatives "is basically a substitute for the ultimate hedge," he said.

Practical Advice

In practice, many enterprises are still coming to terms with these hedging devices. "Often companies only start thinking about this when commodity prices are at their peak," said Bob Bruning, a principal based in the Southfield, Mich., office of management consulting firm PRTM LLC. "Then they go out and hedge 100 percent of their spend," he added.

Enterprises that overcommit in this way can pay a high price. Bulk shipping company Britannia Bulk Plc was tipped into insolvency in November 2008 partly because of losses incurred by a fuel-hedging program. The carrier hedged at a time when oil prices were high and suffered hefty losses when the upward trend went into reverse.

Ideally, hedging should be an integral part of purchasing practice during good times and bad, said Bruning. In other words, don't lose sight of your business model and start to use hedging as a way to speculate. This can be a temptation at present when commodity prices are falling and companies

GET A LOCK ON PRICES

A swap is a financial instrument used in hedging, but what exactly is it? Darrel Ingram, Direct Hedge, headquartered in Geneva, Switzerland, gave a definition of a swap at the Managing Risk in a Volatile Fertilizer Market webinar, organized and hosted by the Pike & Fischer publication *Green Markets* on Oct. 29, 2008.

According to Ingram, a swap is, "a private, principal-to-principal financial transaction where two companies with the opposite forward market risk exposure swap their price risk based on a financial benchmark index with no physical delivery involved."

Ingram gave an example in the fertilizer markets. An importer of urea buys product and is concerned about the price declining while the load is in transit to the United States (see cover graph). The company can choose to buy a swap to protect the price on the downside. "If you have a urea contract from a producer and it's priced on some sort of index, you have the ability to lock that price forward," he explained. Another example is a buyer that wants to protect inventory in storage. To offset the risk of the price deteriorating while the product is idle, the company can sell a swap against it, Ingram said.

A classic example of such deals "is an industrial company locking in raw materials costs," said Ingram. The company can fix prices months ahead or longer. "If they know what their sales price is going to be, it gives them an opportunity to lock prices in."

see this as an opportunity to play the market. Bruning suggested some ways in which companies can develop sound hedging strategies.

Check Out the Options

Look at the different types of hedging possibilities early on before committing to a particular mix of instruments. Simulate the impact of the various options by looking at what the impact each one would have on historical prices as well as projected future prices.

"You need to form a cross-functional team to look at each spending category," advised Bruning. For example, supply chain provides valuable input on demand projections and what needs to be purchased to meet those forecasts. "Make sure everyone is in full agreement from marketing to manufacturing to supply chain and senior management."

Communicate What You Are Doing

Convey the benefits of the proposed program in a language that senior managers can relate to. This is not as straightforward as it sounds. The hedging philosophy "is quite a culture change for some companies," said Bruning, particularly when it comes to accepting the basic premise that the benefits of buying at the lowest price can be outweighed by those of stable pricing. "If you have stable and predictable pricing, it will be better because the company will have a higher valuation," he said.

A recording of the Managing Risk in a Volatile Fertilizer Market webinar, organized by the Pike & Fischer publication *Green Markets* on Oct. 29, 2008, is available for purchase at www.pf.com/eventDetail.asp?id=85&type=2 or by calling Pike & Fischer customer care at 800-255-8131, ext. 248.

Set Targets

A relatively simple way to set a target for a hedging program is to "look at the coverage you have in terms of low, medium, or high volatility and set targets for improvement," Bruning explained. For example you may decide that a 10 percent high volatility management is not enough and that it is prudent to take it to 30 percent.

A more involved approach is to model the impact that pricing volatility has on profitability. "You can take a company's income statement and model or simulate the potential volatility on everything you buy, all goods and services," he said. Using these projections, create a bell curve based on the standard volatility experienced on selected commodities. "You can predict what the operating profit at risk is going to be for the company based on that volatility."

Measured Approach

Hedging is an effective risk-mitigation tool, but it should be used with caution and viewed in the broader context of managing risk in the supply chain. As Swanson noted, "There is no risk management switch that can be turned on and off depending on daily changes of market opinion." ◆

Learning to Live With Fuel Price Swings

How to be miserly with miles

AFTER RISING STEADILY SINCE THE BEGINNING OF 2007, diesel prices peaked this summer and have been falling ever since (see graph). That's good news for cost-conscious supply chain managers—up to a point. Cheaper fuel is a boon for businesses that rely on global supply chains, but managing price volatility is a challenge and the likelihood is that when the global economy pulls out of the recession, oil prices will head north again.

How are supply chain professionals riding the energy cost roller coaster while keeping their performance targets on track? Executives from 15 companies gathered to discuss their strategies at a recent roundtable organized by the MIT Center for Transportation & Logistics (MIT-CTL).

Shifting Patterns

An obvious route to lower fuel bills is eliminating miles from distribution networks. A multinational telecommunications company has rationalized the movements of its 40,000 service vehicles by stocking more parts on the trucks and by repositioning inventory at customer locations. The company has also recruited customers to its fuel-saving efforts by giving them an incentive to be thrifty. If a customer in need of a repair agrees to have the work done at a time when one of

the company's trucks is in the area, the repair is carried out at no cost.

Direct ship—removing as many touch points as possible between point of origin and point of final delivery—can deliver significant fuel savings. An apparel company now ships product directly from manufacturing facilities in Asia to its warehouse in Ohio. The company wants to push finished goods back further upstream in the supply chain and bypass distribution centers altogether by using store-ready cartons packed in Asia. It has implemented an SAP IT system to lay the groundwork for such a system. Another direct-ship option is to use third-party providers of logistics services that offer preallocated shipments to retailers, where items are loaded, labeled, and manifested at the point of origin.

Postponement is another technique that can be used to streamline distribution networks. The final configuration of a product is delayed until more accurate demand information is available. Postponement brings supply and demand into alignment and eliminates unnecessary shipments or loads that have to be expedited because product is in short supply.

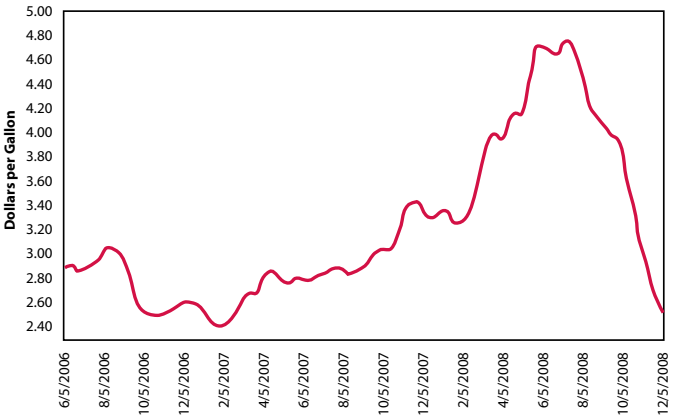
The strategy is not confined to assembled products. For instance, a multinational consumer goods company deconstructed its manufacturing process and found that one critical step, the addition of water to a product, could be postponed. It shifted the step to the distribution segment of the supply chain, enabling the company to better judge demand and to consolidate loads more effectively. The move halved the number of truckloads the manufacturer had to ship.

An international manufacturer of cell phones is trimming its transportation needs by building more flexibility into its manufacturing process. Instead of making finished goods, the company builds core engines to forecast in the Asia-Pacific region and ships the engines to Europe, where it subsequently assembles to order by adding software and accessories. Between 10 and 12 plants, called volume factories, are involved, and these facilities focus on cost-efficiency and large lot sizes. Other manufacturing locations in the company's network are called "value factories" and are primarily concerned with the production of high-end phones.

[Key Takeaways]

- Supply chain managers are learning to cope with fluctuating energy prices by finding ways to cut fuel consumption.
- Using better supply chain visibility to increase their usage of fuel-efficient ocean transportation and the creative deployment of postponement strategies are two methods that are attracting attention.

Weekly U.S. Retail On-Highway Diesel Prices Average All Types



(Source: Energy Information Administration)

Modal Selection

Choosing the optimum mix of transportation modes is another approach to fuel efficiency. A fashion apparel company has achieved a dramatic cut in its use of air transportation, a high-risk strategy in a business that can be devastated by late shipments from far-flung manufacturing centers in Asia. The company has made a number of adjustments that enable it to make timely deliveries even when using slower, more fuel-efficient modes. As a result, it has shifted its transportation mix from predominantly air to 35 percent air and 60 percent ocean.

Shorter design-cycle times help the company avoid costly air shipments. Improved supply chain visibility and responsiveness also play a key role in the switch to ocean. The manufacturer receives alerts within 12 hours of a supply chain disruption occurring. In collaboration with an ocean carrier, the company is able to pull a container from a late vessel—or even a specific purchase order—and transfer it to air if a load has to be expedited. Feeder vessels from major ports are part of the quick-response system. The service is end-to-end; when a disruption strikes, the manufacturer is able to discuss options with individual merchants. As an added incentive, retailer customers are offered on-time guarantees on their ocean shipments as well significant cost savings. Sixty percent of the apparel company's retail customers are taking advantage of the ocean-based delivery service.

Natural Constraints

Clearly there is a huge scope for improving the fuel efficiency of supply chains, but there are limits on how far companies can go. For example, there may be legal mandates or product features that restrict the extent to which companies can reconfigure distribution networks. ◆

[RE]SEARCHING FOR ANSWERS

Where Supply Chain Meets Lean

Taking lean beyond manufacturing

THE PRINCIPLES OF LEAN AND SUPPLY CHAIN MANAGEMENT can be in conflict—for example, when lean operations require inventory to be slashed while supply chain managers are adding to the buffers they need in an unstable market. Lean has not made as many inroads into supply chain as it has within the four walls of organizations—but there are some notable exceptions.

A report by CAPS Research titled *Lean Supply Chain Strategies and Implementation* highlights two, at Raytheon and General Mills. Both companies embarked on lean programs some years ago but fairly recently have extended these efforts into their supply chains.

Although the projects are a work in progress, the firms have chalked up some significant successes both in terms of supply chain efficiency and how companies can frame lean in a supply chain context.

Defense Application

The report is based on presentations, comments, and discussions at a recent CAPS Research Critical Issue Partnership event (CAPS is jointly sponsored by the Tempe, Ariz.-based Institute for Supply Management and the W. P. Carey School of Business at Arizona State University). The author of the work is George A. Zsidisin, associate professor, Bowling Green State University.

The $21 billion defense company Raytheon started a six sigma and lean program in 1999. Initially the effort was focused internally, although the ultimate goal was to apply the principles across the supply chain.

The program identified various forms of waste. For example, lead times were four to 10 times longer than necessary, and there was a tendency to use outsourcing as a solution to fixing flawed practices. Some problems, such as excess inventory, were traced back to customers.

New Approaches

To further increase its performance, Raytheon turned to the implementation of lean in its supply chain. For example, it recognized that suppliers should be viewed not as a repository for defective processes but as an extension of the company's efforts to meet customer needs. Also a part of the new philosophy was that "push" manufacturing processes tend to make alignment between production and material flows more difficult. "Therefore, the lean approach for creating a materials logistics system is being deployed to create lean supply chains," the report said.

A Raytheon business, Integrated Defense Systems (IDS), has a lean program that combines "push" and "pull" manufacturing. The lessons learned from this system are being piloted with a "diamond club" of suppliers, a select group of vendors. Lean practices that have been introduced to the group include on-site help to improve performance on delivery and cost, communicating customer requirements, and hosting operational excellence conferences. IDC has reduced inventory levels by some 30 percent and cut lead times by 40 percent as a result of the program.

Another Raytheon business unit, Network Centric Systems (NCS), set up a supplier relations and supply chain productivity team to promulgate lean in the supply chain. The team's goals include:

- Improving supplier relations and collaborating with customers;
- Mitigating supply risk;
- Contributing to financial and performance improvement through cost, cycle times, quality design, cash, inventory revenue, profit, and responsiveness; and
- Improving internal supply chain processes and procedures, assessing supply chain best practices, and promoting and implementing integrated supply chain principles and practices.

Supplier engagement is a key theme, and NCS has developed a four-stage process for engaging these trading partners:

[Key Takeaways]

» Manufacturing has used lean principles extensively to improve efficiency; the same can't be said for supply chain, which has been a less enthusiastic adopter of these methods.

» Raytheon and General Mills are two companies that are embracing lean from a supply chain perspective. The variety of applications—from improving inventory management to organizational change—gives an indication of the potential gains.

Optimize the Supply Base

NCS had too many suppliers and found it difficult to establish meaningful relationships with every vendor, so optimizing its supply base underpinned the organization's lean supply chain initiative. It approached the task by commodity family and selected leading suppliers from each commodity group using criteria such as quality and financial strength. The strategy thinned out the ranks of suppliers. For example, the number of vendors supplying one item went from 74 to just seven.

Establish an Approved Supplier List

Supply chain and engineering collaborated on this task, because design engineers have to use the supplier list for each commodity; special permission is needed to use companies that are not on the list. The list is revisited periodically and is sanctioned at the vice president level.

Create Commodity Strategies

Closer business alignment between Raytheon and suppliers is achieved through process and relationship diagnostics and analyzing the information flows that connect Raytheon to these organizations. Examples of diagnostics are maximizing visibility, creating communications processes, and managing inventory.

Conduct Commodity or Supplier Engagements

There are three levels of engagement: reactive, proactive, and commodity. Reactive interactions often occur during production in response to an immediate need. The proactive stage involves a supplier development plan based on an examination of its product lines and business areas. Commodity engagements are the most strategic in nature and involve close collaboration with the supplier to create productive, long-term relationships.

Other tools used by NCS to introduce lean to supply chains include process flow analyses and the development of total-cost-of-ownership models. The flow analyses are carried out as a six-step gated process. The first step is to "visualize" selected suppliers by collecting data on them and putting together a business case for further action. In the "commit" step, supplier buy-in is gained and the project scope validated. The "prioritize" step uses return on investment to prioritize projects and leads to the creation of a contract for change. The fourth step, "characterize," consists of assembling the team and determining metrics. The focus is on designing and implementing new processes and control systems in the fifth step, called "improve." Finally the lessons learned are captured in the sixth step, "achieve."

Inventory management is also part of the NCS approach to developing lean supply chains. Solutions are based on four options in descending order of importance:

- Replace inventory with information through improved data and forecasts;
- Leverage supplier-owned inventory to "pull" material from supplier's inventory;
- Leverage supplier-managed inventory; suppliers manage it on the basis of expected demand and agreed minimum and maximum levels; and
- Use third- or fourth-party logistics services providers.

The lean supply chain initiative has yielded a number of benefits for NCS. One lean six sigma project that engaged a supplier aimed to reduce the cost of a power amplifier module. A total of 56 improvement opportunities were identified, and an improved design developed, resulting in an overall financial impact of $2.5 million.

Mapping Lean

Consumer foods company General Mills "is trying to shift to a demand-driven supply chain," the report said. Recent price increases for raw materials, and the fragmentation of markets owing to a growing demand for customized products, two developments that are driving the need for more supply chain agility. But the company's functional silos make the implementation of lean a challenge.

General Mills's sourcing organization began the journey in 2000 with several projects.

A technique that has become an important part of the company's lean supply chain effort is value stream mapping (VSM). After using VSM to analyze its own facilities—each step in the supply chain was evaluated on the basis of 13 key attributes—General Mills found that its supply chain was convoluted and not well-understood. The exercise led to some notable improvements such as shorter lead times and more detailed quality monitoring.

Another supplier-oriented lean project focused on improving customer service in a more uncertain business environment. Frequent order changes and the relative complexity of specifications for raw materials were making it difficult for suppliers to deliver efficiently. A cross-functional team used VSM and continuous improvement tools to tackle the problems and succeeded in eliminating finished product inventory at the supplier, achieving 18 percent cost savings and reducing lead times. ◆

[BACK PAGE] By Ken Cottrill

Cultivating Fresh Approaches to Market Perils

Risk sprouts in U.S. fertilizer markets

RISK MANAGEMENT IS IN VOGUE RIGHT NOW, but unlike many supply chain fads of the past, this one is rooted in real-world issues that directly affect the viability of enterprises across the business spectrum. Check out the fertilizer industry for example, where the risks that organizations are trying to mitigate or remove are playing havoc with supply chains.

The collapse of just-in-time is one manifestation of the uncertainty. The idea of delivering fertilizer in the United States very near to the time of consumption has become impractical. "The just-in-time stocking strategy isn't going to work anymore because the distribution chain is too long," said Dan Cole, managing editor, *Green Markets Dealer Report*, a monthly newsletter published by Pike & Fischer.

A stalemate now exists at both the retail and wholesale levels, he said. Dealers have lots of high-priced inventory that they positioned before the markets caved, so they have little room to store replacement tons offered by manufacturers at much lower prices. Many growers, however, know that the wholesale fertilizer markets for nitrogen and phosphate products have plummeted and, as a result, are hesitant to buy at the retail level, thinking that the longer they wait, the more likely prices will fall. Just-in-time supply may be tested again next spring, and many in the industry fear the potential for supply outages, particularly if the planting season is compressed by weather, Cole said.

Multiple Causes

On a broader level, production has been shifting overseas for some years; more than half of the nitrogen-based product used in the United States is now imported, said Cole. Companies have gone offshore to take advantage of lower energy prices. Natural gas is a feedstock for crop-nutrient products, and the cost of this raw material has increased alarmingly over recent years. Manufacturers have built plants in countries such as Trinidad that offer relatively cheap supplies of natural gas. These investments are a disincentive to bringing production back to the United States when natural gas prices fall.

In addition to stretching supply chains across borders and making them more vulnerable to disruptions, the migration of production facilities to low-cost countries triggers ripple effects in the United States that add to the industry's insecurity. American producers of raw materials naturally chase markets wherever they may be, and in this case, that means manufacturing sites in countries such as Trinidad. The increase in export volumes can cause domestic supply problems. Potash has been in short supply in North America over the last year or so.

U.S. fertilizer suppliers also have to deal with the vagaries of the agricultural industry. Predicting the demands of the next growing season is notoriously difficult. As mentioned above, dealers are sitting on large inventories because the last fall season was relatively poor for farmers and the spring season before that was lackluster as well.

Finally, there are geopolitical variables that muddy the demand picture. World prices for agricultural commodities such as wheat and corn are always subject to changing political and economic winds, which have be blowing at gale-force strength over recent years. One example of this is the generous subsidies given to ethanol producers by the U.S. government that have driven up the production of corn, which is a raw material for the fuel additive.

New Sense of Balance

Market uncertainty is giving U.S. fertilizer suppliers heartburn, which is where risk management comes in. These businesses have always had to be adept at juggling inventories to make a profit, but in today's commercial climate, they have to go one step further by becoming better at protecting their businesses against erratic shifts in supply and demand. "There is no simple answer," said Cole. The dealers have to learn how to balance supply risk, demand risk, and price risk in a gyrating market (see "Hedging Know-How That Pays Dividends" on page 6 for more on this).

These capabilities will continue to be important after the credit crisis has played out. As the economic pendulum swings back toward growth, the resource-constrained environment that existed before the recession will return, causing imbalances in supply and demand. Risk management is one fashion that will keep coming back. ◆

Ken Cottrill of the MIT Center for Transportation & Logistics edits *MIT-CTL Supply Chain Strategy* and can be reached at kcottrill@IOMA.com